



Teacher Education Modality Rapid Review

Modes, Affordances and Evidence on
Remote and Blended Initial and
Continuing Teacher Education

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About this review

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The Department of Teacher Education offers initial and continuing education to teachers and leaders throughout the West Midlands region and attracts educational leadership students from across the world. Several members of the review team, including the principle investigator, are linked with the UoB Educational Leadership Academy, which seeks to advance research, professional learning and collaboration across the region in line with the School's mission of *Advancing Education*.

Centre for the Use of Research and Evidence in Education (CUREE)

CUREE is an internationally acknowledged centre of expertise in school and college improvement, and evidence-informed leadership, policy and practice in education. Led by its Chief Executive, Philippa Cordingley CUREE staff use their knowledge and skills in teaching, research, communications and knowledge management to produce high-quality research, CPD, tools and resources. CUREE works with and for schools and colleges, academy chains, teaching schools and other clusters and alliances, with professional associations, universities, and government departments and agencies in the UK and worldwide. Further details of CUREE and their work can be found on their web site: <http://www.curee.co.uk/>

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Executive Summary

Overview of Review

Aims

At present there is not an established body of literature or systematic review focused specifically on effectiveness of/within modes of teacher education. In this review we bring together relevant studies with the potential to provide an evidence base for effective practice for **remote and blended teacher (initial and continuing) education**. We also revisited existing general teacher education reviews and meta-analyses with a specific focus on identifying evidence and implications pertaining to teacher education modality.

Research Questions

1. **Approaches** – What forms of/approaches to remote or blended teacher education have been explored in the research literature? What are its typical characteristics/elements? How can this be organised?
2. **Affordances and Limitations** – What are the affordances and limitations of remote and blended teacher education relative to face-to-face variants? What adaptations, restrictions or enhancements are typical relative to face-to-face variants?
3. **Evidence** – What empirical evidence is available that supports, refutes and/or refines our understanding of effective remote or blended teacher education (as per Q2)?
4. **Implications and Unknowns** – What, if any, general principles for effective remote or blended teacher education are evident? What does the evidence suggest about the relative effectiveness of teacher education modalities (including in comparison with the face-to-face mode)? What are the main areas of uncertainty and gaps in our present understanding?

Methods

Given the time and budget constraints for this project, two review approaches were blended to produce the most useful and highest-quality review.

- **A Review of Reviews** – to a) identify findings pertaining to modality in existing reviews and b) identify implications of CPD and ITE reviews for modality. This portion of the review was more exploratory and sought to surface and discuss affordances and limitations for remote and blended teacher education.
- **A Rapid Review** – This aspect of the review used systematic review techniques to locate and review trials of online or blended initial or continuing teacher education programmes. This review focuses on evaluations of the effectiveness of remote and blended programmes compared to a control group as well as (a very small number of) evaluations specifically designed to compare the effectiveness of similar programmes offered in different modes.



Main Findings

What does the research tell us are the key elements of effective teacher education that makes a difference to pupils as well as teachers?

Our review started with the premise that we should not be confusing the medium (and the structure) of teacher education for the message. Whether online, face-to-face or a blend of these, teachers must go through a familiar set of thinking and practice development processes. Insofar as there are separate principles for effective blended and remote teacher learning, they will relate to how we can employ new approaches, mitigate their limitations, and realise their affordances in recognition of the more general set of teacher learning principles.

Accordingly, we first present in our literature review, a summary of principles for effective ***Continuing Professional Development and Learning (CPDL)*** and its leadership, and for effective ***Initial Teacher Education (ITE)***, as compared to the general CPDL principles (see Box 2 and 3, pp. 6 and 9, respectively). Initial training, especially in England where it is condensed into single year, inevitably faces the question of how to squeeze a large foundational curriculum and time-consuming practice development into a very short space of time to ensure pre-service teachers are ready for the classroom. There is an inevitable need to continue some of this foundational learning in the early years of the teacher's career, and so we note that our principles for ITE will continue to remain relevant for early-career teachers in addition to principles for effective CPDL more generally. *We employ the principles for teacher education presented in the literature review to structure the discussion within our second research question on affordances and limitations of remote and blended modes.*

1. Approaches – What forms of/approaches to remote or blended teacher education have been explored in the research literature? What are its typical characteristics/elements? How can this be organised?

We have developed a simple two-part typology of remote and blended teacher modes; this was based on similar frameworks in the literature and the range of approaches evident within the empirical studies within the review. We have not grappled at any length with how one might define a 'mode' nor attempted to produce an exhaustive, discrete, and empirically-grounded set of categories. Our model is a pragmatic attempt at describing different approaches from the remote and blended teacher education landscape.

We have identified ***six general modes of online or blended teacher education***:

- ***Lectures, workshops, seminars, discussion groups or conferences***, including one-off sessions and series. This mode tends to centre on dialogue and/or the sharing of expertise and experience through discussion or presentation. There is typically a defined focus and often specific curriculum content to stimulate and shape exchange. The level of interactivity and structure provided varies within the mode: for example, one-off, didactic lectures are quite different from an ongoing informal and unstructured conversation within a professional learning community. Remote and blended variants of teacher education in the mode typically make use of video technology and/or text-based communication media as a medium.



- **Coaching and mentoring** – as practices, coaching and mentoring are already well defined and have a strong evidence base demonstrating their impact on teacher learning and pupil outcomes. Remote and blended variants make use of audio, video and/or text-based communication technologies as a medium of communication.
- **Classroom observations with feedback and/or discussion** – taking classroom observation into remote and blended teacher education often takes advantage of video recording or live streaming to enable asynchronous and remote viewing, respectively. This mode is typically incorporated into other modes, with, for example, video recordings of classroom teaching brought into workshops or mentoring sessions for discussion.
- **Resource bases or repositories** – which contain a huge range content from classroom plans and resources, videos, guides and tools. Resource bases have varying degrees of user interaction, user content creation, and curation and quality assurance. This mode is often paired with other modes which seek to make use of, discuss or develop the resources in question; arguably, this is not a mode in of its self but rather a way of organising content to be engaged with via another mode.
- **Platforms and self-study programmes** – ranging from less to more structured programmes that give access to curated/designed resources, learning content, assessments and/or directed activities to learners. These are variable in content, activities and quality and tend to perform multiple functions including organising and supporting other teacher education modes; for example, a programme consisting of a curated resource base and learning content supported by collaborative activity and discussion would typically make use of a platform (often referred to as a virtual learning environment).
- **Virtual reality spaces or simulations** – while there were very few examples of studies examining this mode in the literature, there are some teacher education programmes and a small but growing literature on the use of virtual or augmented reality simulations, worlds and activities for teacher education.

We examined how teacher education practices vary within these modes and identified several cross-cutting factors which can be used to characterise most or all of the modes and the programmes we identified. While not exhaustive, the following list is derived from our analysis of reviews and empirical pieces describing teacher education programmes.

Cross-cutting factors we found to characterise these modes are:

- a) **(A)synchronicity** – With most of the above, it is possible to design asynchronous, synchronous and mixed variants. The advantages of each of these is discussed below.
- b) **Interactivity** – Teacher education varies within and across programmes in the opportunities for interaction versus passivity, and the extent to which teachers are placed as consumers or producers.
- c) **Community** – Programmes can be designed to be more or less collaborative, many seeking to form or situate activity within ‘**Professional Learning Communities**’ (PLCs).
- d) **Choice of (Multi-)media** – In remote and online teacher education programme design, there is often a choice to be made between the use of video, audio and/or text as a medium of expression, for discussion or to convey information. Teacher education designers are now able to choose from several media and are typically opting for multimedia approaches. Moreover, as technology has improved, the inherent benefits of the media can be foregrounded in decisions, rather than the practicalities (e.g. cost and convenience) of the technology.



- e) **Combining Elements** – Many programmes combine the overall modes, e.g. provide an online seminar followed by remote coaching. This is worth considering in relation to affordances below, that programme elements can be combined to ensure ‘coverage’ of teacher learning aims and principles and allow each medium and element to ‘play to its strengths’.
- f) **Structure, design and facilitation** – Programmes vary in the extent to which they have been actively designed (as opposed to spontaneous and ‘crowd-sourced’) and the extent to which the activity is actively kept to this design through facilitation, direction (in person or through technology and activity timings and content). There are also more general organisational issues around the number, length and timing of programme inputs. While these may feel prosaic unimportant, these can have a significant impact on the impact of the teacher education and affordances around blended modes and activities (see below).
- g) **Providers/Partnerships** – One other consideration is about the provider(s). Many teacher education programmes were delivered and/or designed by a combination of one or more teacher groups, schools, universities, and/or local/national authorities working in partnership.
- h) **Focus and purpose** – A final key area of difference apparent in the literature is the extent to which teacher education in different modes is focused on/centred around a practical purpose (e.g. increasing STEM participation), by identity (secondary biology teachers discussion groups) or with a curricular/learning focus (learning and applying the principles of cognitive science).

2. Affordances and Limitations – What are the affordances and limitations of remote and blended teacher education relative to face-to-face variants? What adaptations, restrictions or enhancements are typical relative to face-to-face variants?

There is currently great value in reviewing the affordances and limitations of modes and technologies of teacher education in relation to and while not losing sight of teacher education principles, not least because of the possibilities and potential for missteps of the rapidly developing potential for remote and blended teacher education being opened up by technological development and circumstance (including the present Covid-19 pandemic).

While one modality may not be necessarily superior to others and the implementation is as important as the design, the affordances and limitations of the modes do seem to vary. We think that certain modes (such as mentoring and coaching enhanced with video lesson observations) stand out as being not just acceptable alternatives to face-to-face practice, but as having huge potential for both quality and practicality reasons. On the other hand, use of resources bases, certainly without the support of other modes, presents many more challenges for meeting teacher education principles (as well as unique potential benefits). Indeed, *the fact that many programmes are combining modes and approaches is often in deliberate recognition of the strengths and weaknesses of each mode* (Elliot, 2017). There is, therefore, value in attempting to grasp these.

We should stress that discussion of remote and online in this section is exploratory in nature – based on our interpretation of the literature along with our own expertise and experience.



We examined the affordances and limitations of remote and blended teacher education modes in relation to the following general areas, aligned with *principles for effective teacher education*.

Pupil orientation

A key teacher education principle is that it should have a *pupil orientation* (i.e. overt relevance of content to its participants and their day-to-day experiences and aspirations for pupils, and activities should be organised around this). *Perhaps surprisingly, there is very little focus on pupil outcomes in the remote and blended teacher education literature, much of which is focused on changes in teacher practices or thinking and/or teacher perceptions of new ways of learning.* It is a concern that such a large proportion of pieces describing and evaluating teacher education programmes paid such little attention to what, if any, benefits and impacts there were for pupils.

This also means that there is little to go on for exploring pupil-focused approaches in remote and blended teacher education. What we do have suggests that *there are no modes within our framework for which it is not possible to include substantial consideration of pupil outcomes, and many which have advantages (such as cost and ability to create a larger community) when compared to face to face methods.*

Discussion of pupil outcomes is made easier when student assessments or artefacts (e.g. pupil work) as stimulus material and classroom video are built into the teacher education to make links between teaching and learning. *Technology (and especially video) has the potential to bring classroom interactions into a teacher education space for examination, discussion and reflection, without the expense of face-to-face observations* (i.e. around release time) and the reliance on memory – which will be most fresh immediately after the teaching and increasingly distant as time passes.

Collaboration and support

With this principle and others, it is important not to take the simplistic interpretation that its mere presence will make for effective CPDL, or indeed that it is either a necessary or sufficient condition for effective CPDL. Collaboration can be a superficial ‘sharing of best practice’ or a rich exchange orientated towards how pupils are responding to teaching practices and curriculum, examining theory and practice side by side through iterative classroom ‘experiments’, and that is sensitive to participants’ level of experience (i.e. the other teacher education principles).

When it comes to high-quality collaboration in a remote and blended space, a key concept is that of ‘*presence*’. *While high presence, in the above terms, appears to be possible, it also seems to need careful consideration when designing remote and blended teacher education.* High participant attrition seems to be a general issue for online modes of delivery as well as the issue of non- or highly-passive participation, with interactions being overly tutor-initiated and student responses limited in number or depth. The inherent limitation of all non-face-to-face interaction, as Quinn et al. (2019, p.410) explain, is that ‘in online settings, the capacity to read body language and facial expression is limited, especially if communication is primarily through text, which challenges the intimacy and immediacy required for social presence (Tu and McIsaac 2002).’

Related, is *the value of facilitators and moderators* in online spaces. Dede et al. (2016) devote a chapter (10) to the role and ‘importance of moderators’ within online STEM CPD, they describe their roles in online communities as being to: ‘facilitate organisation, welcome newcomers, encourage contributions, support top



contributors, foster commitment, address problems and model good behaviour' (p.274). *Expectations around participation, and preconceptions about these, seem to vary with teacher education modes as well as potentially being influenced by facilitators and formal or informal rules and etiquettes.* Getting the balance right between co-ordinated and/or mandated activity and spontaneous participation seems to be a common consideration in the literature.

A theme within the teacher education principles relating to collaboration is the value of *forming a professional learning community and working to orient teachers, and especially pre-service teachers, to participate within it.* It is possible to wrap community elements around other (including more individualistic) teacher education approaches. Much attention is paid to culture and community development in the literature and reviews generally paint a positive picture of the potential to achieve this in online spaces.

Overall, our reviews suggest that collaboration, including (emotional and pedagogical) support and belonging within professional learning communities is both possible and evident in remote and blended modes of teacher education, both formal or informal (but see Lantz-Andersson et al., 2018), and for both novice and established teachers (Lantz-Andersson et al., 2018; Surrette and Johnson, 2015).

Diagnostics, differentiation and teacher starting points

Modes that are built around the teacher education participants, such as mentoring or teacher-led discussion groups, lend themselves to diagnostics and differentiation in relation to teacher starting points. This seems to remain the case whether conducted in a face-to-face, remote or blended mode.

In our analysis we discuss several trade-offs for remote and blended programmes relating to programme content, structure and assessment:

- **Content** – the greater range of content available, the more tailored it can be to support individual teacher needs; but with more content comes a greater risk of overload and difficulties supporting participants to focus in on and discuss fundamentals.
- **Structure** – programmes can be structured around curriculum content and in line with effective teacher education principles; too much structure however can reduce opportunities to tailor teacher education according to teachers' aspirations and starting points. Our experience of MOOCs is that many have set content structured into weeks or modules, and provided by instructors, which are then 'softened' by the presence of community building features such as discussion boards.
- **Personalised Assessment** – Looking at the literature, great claims are made about the potential for personalised learning via technology in teacher education and education more generally (claims yet to be backed by substantial and robust evidence). A widely advocated variant of this idea is that a combination of learning analytics (from simple scores to analysis through artificial intelligence and machine learning) and 'micro-credentials' or units can make even the most structured and content-heavy programmes highly accessible and differentiated for individual needs.
- **Formative Assessment** – Another consideration relating to assessment connects the above conversation about 'presence' to the question of feedback and honest, challenging and searching conversations about practice. Fear of criticism can be a barrier to participation in online communities (Khalid and Strange, 2016) and so diagnostic conversations or assessments of teacher practice often need to successfully navigate sensitive issues, despite – to varying degrees – some of the more human elements of interaction being pared back when interacting remotely or in an online space.



Theory and practice, experimentation and contextualisation

While the focus has been more on reflections than iterative development of practice as part of or alongside teacher education *per se*, *the literature was broadly positive about the potential of remote and blended programmes' potential to support reflective practice.*

Combining theory and discussion, expert models of practice, and one's own practice requires focus and experimentation over time (see points around duration, below). The literature suggests that this made easier and richer through *artefacts, tools and technologies that bring practice and pupil learning together and across classroom and professional education spaces.* This is as true for face-to-face as online/remote teacher education and, arguably, the latter has the affordance of a greater range of technology and multi-media at one's fingertips to be able to achieve this. Moreover, asynchronous teacher education approaches and content allows professional learning to run alongside and shape to classroom activity over time.

Video technology is of particular note as it enables teachers to 'rewind and review the video and record more complete and accurate comments than is possible during real-time observations' (West et al., 2009, p. 384, quoted in Surrette and Johnson, 2015, p.263). Using video, there is also a greater opportunity to conduct the reflections and discussions collaboratively, drawing on a greater number of examples (Perry et al., 2020).

Curriculum and specialist expertise

Online modes and technology can be used to bring together larger groups, which are more likely to incorporate and/or find it more economical to draw on specialist expertise (including top scientists, public figures and outstanding leaders and practitioners etc.), as well as develop subject-specific content. With larger-group modes such as MOOCs this is further accentuated, although Dede et al. (2016) note that splitting up by subject specialism sometimes reduces opportunities for cross-pollination of ideas and connection.

Overall, there seems to be a strong case that online teacher education, particularly when built around platforms and/or resource bases, and a strong curriculum content offer with specialist input is eminently possible, and indeed has many advantages over exclusively face-to-face approaches, including the ability of teachers to locate specific (e.g. 'just-in-time') content, fitted to their needs, and work through and engage with it individually or collectively in their own time. Discussion of the difficulties of achieving this in online spaces and communities tend to touch on the danger of superficial engagement with other members of the community or programme content.

Duration and organisation

The additional flexibility around timings (including remote and asynchronous participation) afforded in remote and blended learning approaches, combined with the use of technology and pedagogical/reflection 'smart' tools is a supportive factor for practicably sustaining teacher education over time. Technology can be used to organise teacher education content and activities to fit around (or within) teachers' individual and collective needs and circumstances. Flexibility in design and delivery is discussed by authors such as Burns (2011) who cautions against the view that 'face-to-face curricula can be transferred wholesale to a distance education format' and discuss 'flexible design' principles that 'content be organized in multiple formats, used in a variety of activities, and accessible through a variety of technologies to allow for customized learning experiences' (p.138-9).



As a general rule, flexibility around timings and online approaches helps teachers fit learning around their professional commitments and school timetables, avoid the need to use weekend days for group activity and better fit with personal circumstances. The only negative point in this area we found in reviews was the concern in Lantz-Andersson et al. (2018, p.312) that 'flexibility also introduced a risk of 'never-ending' engagement, and online professional learning encroaching into teachers' non-work time and becoming an additional source of over-work'.

3. Evidence – What empirical evidence is available that supports, refutes and/or refines our understanding of effective remote or blended teacher education (as per Q2)?

- a. Which forms or practices are identified as more/less effective?
 - b. What are the common features of effective approaches?
-

In our evidence review section, we report results from 24 empirical studies meeting our inclusion criteria. The first 19 present empirical results (including evidence of impact or otherwise on pupils) of remote and/or blended teacher education programmes and therefore present evidence about whether or not remote or blended programmes *can* be effective. The final 5 include consideration of more than one mode (remote, blended and/or face to face) and thereby enable a form of comparison between modes. Our evidence was insufficient to begin to answer questions about common features of effective approaches.

The Efficacy of Remote and blended Teacher Education

In this section we summarised studies within three groups:

- **Coaching and mentoring interventions** – these showed positive results for changing teacher practice and mixed results for positive pupil impact. Allen et al. (2015) present a randomized controlled trial of the *My Teaching Partner–Secondary (MTP-S)* programme, a web-mediated coaching programme involving 86 secondary school teachers and 1,194 secondary students. Students' scores on standardized tests rose significantly (Effect Size = 0.48) compared to controls. In contrast, Kraft and Hill (2020) reported a randomized field trial of a web-based coaching programme designed to improve teaching of mathematics in relation to a *Mathematic Quality of Instruction (MQI)* framework. Their results showed improved teaching using the MQI instrument and a higher likelihood of teacher retention for teaching maths, but student gains were estimated to be minimal. Results from the Snell et al. (2019) review were similarly mixed: from a small number of studies they found one study reporting positive pupil outcomes through remote live coaching, one finding little evidence on pupil impact with remote asynchronous coaching, and one with mixed evidence for pupil outcomes with blended technology enhanced coaching.
- **Mixed component interventions** – similar to the coaching and mentoring programme evaluations, evaluations of mixed component interventions tended to report changes in teacher outcomes such as pedagogical content knowledge (e.g. Dash et al., 2020), but there was a mixed picture when it comes to pupil outcomes, with some studies finding positive effects (e.g. Ascetta, Harn & Durán, 2019) and some finding none (e.g. Goldenberg et al., 2014; Dash et al., 2020). There were studies which presented findings suggesting a positive impact on pupil, but many had methodological limitations, making it difficult to draw robust causal conclusions.
- **Interventions for student behaviour** – there were two studies focused on student behaviours. One, as per many of the programmes above, reported teacher but not pupil impacts (Marquez et al., 2016). The other, Hoffman et al. (2020), was a randomised controlled trial focused on physical activity and wellbeing for



young children and a positive impact on the amount of additional moderate-to-vigorous physical activity per week for students of teachers receiving the intervention.

Overall, this very small evidence base suggests that remote and blended teacher education programmes can, and often do, have an impact on teacher outcomes, and can, but often don't have an impact on student outcomes. The 'best bets' based on this evidence seem to be for coaching and mentoring interventions, but this is more a reflection on what has been evaluated and reported rather than a comparison of impact between programme types. We should add that none of these studies make comparisons between modes and programme quality appears to be variable; this evidence therefore does not put us in a position to conclude whether the above results are better or worse than for 'traditional' face-to-face teacher education of comparable quality, only that it is possible to have a positive impact through remote or blended teacher education.

Comparing the Effectiveness of Teacher Education Modes

In our review, we located five evaluation studies, one meta-analysis (Hill et al., 2020) and a systematic review (Snell et al., 2019) which present results that allow comparison of the effectiveness of teacher education modes or combinations of them.

The small number of studies we had suggest that there was no difference in impact between comparable teacher education offered in different modes. The strongest two studies in terms of research design found no difference between modes:

- Fisher et al. (2010) compare a virtual workshop with an actual workshop, both focused on developing a Concept Mastery Routine (CMR). The study recruited 59 certified teachers and randomly allocated them to one of the two groups. ***Comparisons of pre and post test data revealed no difference in student tests of concept knowledge between the students of teachers who participated in the face to face or virtual PD, although teachers expressed slightly more satisfaction with face-to-face PD.***
- Fishman et al. (2013) conducted a randomised experiment involving a total of 49 teachers that compared online and face to face professional development. The PD aimed to prepare high school teachers to implement a year-long environmental science curriculum. Teachers either received a week-long (48hr) course spread over 6 days, consisting of face-to-face workshop sessions or an online alternative 'to be completed by teachers asynchronously at their own pace', consisting of a series of 'short courses with a facilitator guiding teachers and answering questions as they worked through the materials' (p.429-430). ***Fishman et al. (2013) found similar increases in teacher subject knowledge for both online and face-to-face groups, no differences between the conditions across a range of teacher attitudinal measures, and an increase in student scores on an environmental science scale of around half a standard deviation for both conditions, slightly higher for the online condition.*** They also found little relationship between teacher online 'contact hours' and student performance and suggest that teachers could go at their own pace through the materials, receiving similar benefit.

The other three studies meeting our eligibility criteria, albeit with some limitations in their research design provide similar results:

- Rock (2017), presented results retrospectively comparing student assessment scores for students of teachers who participated in online or face to face state-grant-funded professional development. They



concluded that, ‘when the content of professional development is comparable, the form of professional development and the level of instruction have minimal effect on student learning outcomes.’ (p.186);

- Webb, Nickerson and Bush (2017) present a comparative analysis of student survey responses (n=4,832) between teachers (n=75, K-12) who undertook different modes of professional development in the context of a computer science (game design) curriculum. There were very little differences across the survey items when comparing students of teachers who received professional development in different modes.
- Russell et al. (2019) compared, through a randomised design, the effects of a professional development course for teachers of maths in grades one to five in an online and a face-to-face format. Using a range of data sources, they found that, ‘both formats of the course showed significant impacts on teachers’ mathematical understanding, pedagogical beliefs, and instructional practices’ (p.71). A student survey asked about instructional practices of the teachers and their quality; no statistically significant differences were found between online and face-to-face groups.

We also examined results from two reviews. The first was meta-analysis by Hill et al. (2020) of the effect of STEM professional learning programmes according to various PD characteristics relating to its development, type, focus and – pertinent for our review – format. *Their results from the 95 studies within the meta-analysis suggest that ‘Any Online PD’ (i.e. not entirely face-to-face) tends to have positive, but lower effects than other formats, with about half the overall increase. Whether this is reflective of the quality of the online programmes or is something related to the mode per se is difficult to determine from this brief and ‘high-level’ view meta-analysis.* A fair comparison between modes would deliver the same content through more than one mode, as above, rather than programmes that ‘naturally’ do or do not include an online element (which may be of a different nature or quality for reasons other than the mode).

Finally, we examine the systematic review reported in Snell et al. (2019). This reviewed evidence for various professional development programmes in language and literacy for teachers in early years settings. They report studies such as Powell et al. (2010), which found similar effect sizes for asynchronous coaching with teachers sending videos to their coach compared to live, in-person coaching for early literacy development; and Pianta et al., (2008) who found that an online course had no effect on its own, but had an impact with combined with asynchronous coaching. In terms of impact (or not) on pupil outcomes, as with the studies we report above, many studies reported null results. *Overall, Snell et al. (2019, p.216) conclude that ‘Tech PD programs can be as effective as in-person PD programs, with effect sizes in the moderate to large range for impacts on teaching practices (i.e., Cohen’s $d > .5$) and in the small to moderate range for impacts on student learning (i.e., Cohen’s $d = .2-.5$)’.*



4. Implications and Unknowns – What, if any, general principles for effective online or blended teacher education are evident?

- a. What does the evidence suggest about the relative effectiveness of teacher education modalities (including in comparison with the face-to-face mode)?
 - b. What are the main areas of uncertainty and gaps in our present understanding?
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Relative Effectiveness of Teacher Education Modality

Remote and blended teacher education is a relatively new field of practice and study. There are few studies that enable firm conclusions to be drawn on the relative effectiveness of modes and approaches. While we hold that there is value in examining modes and their respective affordances and limitations (especially given recent technological advances and the present circumstances surrounding the Covid-19 pandemic), it is likely that differences in medium will not be the main consideration for teacher education quality: programmes will tend towards a blend of media and approaches and their distinguishing quality factors will relate to teacher education principles and whether these have been achieved rather than the mode.

The few studies we have to go on (i.e. which allow fair comparison between similar content in different modes or combination of approaches) suggest that there is little difference in effectiveness (Fisher et al., 2010; Fishman et al., 2013; Rock, 2017; Webb et al., 2017; Russell et al., 2019). This includes studies presenting results from randomised experimental designs assessing impact on teachers' student's attainment (Fisher et al., 2010; Fishman et al., 2013). In the closest systematic review to our own, focused on language and literacy PD in the early years, Snell et al. (2019, p.216) conclude 'that Tech PD programs can be as effective as in-person PD programs'.

There are tantalising findings about combining components such as coaching and mentoring with video lesson observations, curriculum materials and/or CPD – but with such a limited evidence base, drawing conclusions would be over-reaching.

Design Principles for Teacher Education Modality

The field would benefit from scholarship that leads to 'research-based design principles to guide the ongoing development, implementation, and evaluation efforts in online PD'. There has been a great increase in the literature in recent years, but only modest steps made towards this goal. We have been able to report on a larger, but still limited literature. Even in the most highly researched areas, such as around professional learning communities (see Lantz-Andersson et al., 2018), more research is needed.

Given these limitations in the literature, the set of principles, affordances and limitations described in this report can be seen as both a statement from the literature of **working principles for online or blended teacher education design** at the same time as **a set of hypotheses and research questions** that are yet to be established and need to be tested and developed through teacher education research and practice. So, while many plausible principles are apparent, we simply do not have firm evidence back these up at present.

We do however think that *the literature suggests that remote and blended teacher education show considerable promise; that they have distinct advantages and disadvantages relative to solely face-to-face approaches; and that they already are and are likely to increasingly become important parts of the teacher education landscape.*



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Introduction

Review Background

It is widely acknowledged that teaching quality is the largest single factor affecting student achievement that is amenable to school and policy influence (Slater et al., 2012; Kane et al., 2013). Teacher education, including initial education and continuing professional development, is therefore arguably the most direct, effective, and cost-effective approach to school improvement (Fletcher-Wood and Zuccollo, 2020). We know it is possible to improve teaching effectiveness in STEM subjects (Hill et al., 2020) and across the curriculum (Kraft and Papay, 2014), and that there are also wider benefits of doing so including greater collective teacher efficacy, wellbeing, retention and recruitment, in particular for early-career teachers (Fletcher-Wood and Zuccollo, 2020; Cordingley et al., 2019).

In recent decades, as technology has developed, organisations providing initial and continuing professional development for classroom teachers have increasingly developed blended learning offers, combining distance with face-to-face provision of professional learning content and activities. This slowly increasing trend towards distance and blended forms of teacher education has accelerated rapidly in the context of Covid-19 for many providers are reviewing their offer. Initial teacher education providers, for instance, have had to rapidly prepare and deliver online provision to enable students to continue with their education, and to enable finalists to be recommended for Qualified Teacher Status (QTS). Online provision has included video and voice-over to supplement PowerPoint presentations, video-capture lesson recordings, discussion boards, and virtual learning environment chat rooms to ensure that students' knowledge and skills continue to develop while face to face contact was not possible.

More widely, there is a longer history of using blended learning for teacher education in developing and developed countries (e.g. see Burns, 2011, discussing initial teacher education). Australia has a particularly long history of trying to meet CPD and teacher education needs remotely because of its topography; indeed, wireless education for teachers is a venerable forerunner of remote and blended CPD. Dymont and Downing (2020, p.316) report that 'between 2005 and 2016, the number of ITE students choosing an online or blended mode of study in Australia nearly doubled: from 5,412 (22% of total) in 2005 to 12,143 (41% of total) in 2015 (Australian Institute for Teaching and School Leadership (AITSL), 2016). Of the 47 providers of ITE in 2015 in Australia, 19 (40%) offered some or all of their courses in an online or blended mode of study.' This is also reflected in the academic literature, with Dymont and Downing being struck by the exponential increase in material when preparing their review in 2019, as compared to a 2013 review.

Similarly with the literature on remote and blended continuing professional development: back in 2009, Dede et al. (2009) described much of the literature in the field of online teacher professional development as 'anecdotal', urging researchers to work towards an 'evidence-based conceptual framework that provides robust explanatory power for theory and model building' (p.8). Five years later, Fishman et al. (2014a, p.261), were agreeing with Moon et al. that "the field would benefit from scholarship that leads to 'research-based design principles to guide the ongoing development, implementation, and evaluation efforts in online PD (Moon et al., 2014, p.1)'" . Now, another 6 years (and a global pandemic) later, this *Teacher Education Modality Rapid Review* takes another look at the *Approaches, Affordances and Evidence on Remote and Blended Initial and Continuing Teacher Education*.



Review Aims and Overview of Methods

At present there is not an established systematic review focused specifically on effectiveness of/within modes of teacher education. Initial scoping suggested that the evidence base in this area would be disparate, and there would likely be challenges applying it to a Covid-19 or post-Covid-19 scenario. With few common definitions and considerable variation in practices, there were also likely to be challenges delineating between modalities that fall between the face-to-face and fully online poles. Nonetheless, we set out to identify relevant studies with the potential to provide an evidence base for effective practice. We also revisited existing teacher education reviews and meta-analyses with a specific focus on identifying evidence and implications pertaining to teacher education modality.

In this review we address the following questions:

Research Questions

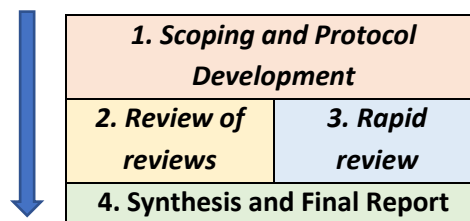
1. **Approaches** – What forms of/approaches to remote or blended teacher education have been explored in the research literature? What are their typical characteristics/elements? How can this be organised?
2. **Affordances and Limitations** – What are the affordances and limitations of remote and blended teacher education relative to face-to-face variants? What adaptations, restrictions or enhancements are typical relative to face-to-face variants?
 - a. What, from a theoretical standpoint, can be inferred from the literature on effective continuing professional development and learning (CPDL) and initial teacher education (ITE)?
 - b. What is advocated as best practice in the remote/blended teacher education literature?
3. **Evidence** – What empirical evidence is available that supports, refutes and/or refines our understanding of effective remote or blended teacher education (as per Q2)?
 - a. Which forms or practices are identified as more/less effective?
 - b. What are the common features of effective approaches?
4. **Implications and Unknowns** – What, if any, general principles for effective online or blended teacher education are evident?
 - a. What does the evidence suggest about the relative effectiveness of teacher education modalities (including in comparison with the face-to-face mode)?
 - b. What are the main areas of uncertainty and gaps in our present understanding?



Overview of Methods

Given the time and budget constraints for this project, two review approaches were blended to produce the most useful and highest-quality review.

- **A Review of Reviews** – to a) identify findings pertaining to modality in existing reviews and b) identify implications of CPD and ITE reviews for modality.
- **A Rapid Review** – systematically searching reviews and trials of distance and/or blended initial or continuing teacher education interventions. This includes studies of the relative effect of teacher education modality. In line with previous reviews of effective CPD (e.g. Cordingley et al., 2015) we restricted our focus within the systematic element of the review to programmes reporting pupil outcomes (see below for further discussion of this point).



Searching Overview

This review obtained 7,354 records from 5 search databases, containing dozens of library collections.

We first screened these on titles for relevance and to remove duplicates, leaving 1,716 records. We followed this with screening on our eligibility criteria (see Appendix 1) using titles and abstracts (retaining 989 records) and then applying the same criteria to screening the full texts, retaining 73 documents. We retained a total of 19 Background and wider pieces which, while they did not meet all eligibility criteria, were retained to provide background information and/or illustration of the results. We also included several other pieces that were known to the team (see 'Other Pieces', Appendix 2) and identified 4 'late entries' – 3 reviews and one empirical piece (reporting early results of a programme).

In the Evidence Review section, below, only (24) pieces, fully meeting eligibility criteria, are reported. In our wider discussion of approaches and their affordances (Q1, 2, 4 and 5, as above), we draw on the full database, with a focus on the most up-to-date, relevant and high-quality reviews. All papers to which we refer are cited throughout the piece. A full list of references by group is provided in Appendix 2.

Further details of the review methods are located in the appendices, including a systematic review protocol, a description of the process for the review components above, a search term record, inclusion and exclusion criteria, an overview table for all empirical studies, and a full reference list for the review database.



Definitions of Key Concepts

Below are definitions for selected concepts used within this review. This list draws on Cordingley et al., (2018, p.32), a previous review involving several of the present authors, and Burns (2011, p.275), a comprehensive report on Distance Education for Teacher Training.

Box 1 – Definitions of Key Terms

Teaching and Teacher Education

Continuing Professional Development (CPD): The sustained support offered to teachers to develop their skills, knowledge, and experience, beyond their initial teacher training.

Continuing Professional Development and Learning (CPDL): The processes and activities teachers undertake as they participate in and respond to CPD.

Pedagogy: The discipline that deals with the theory and practice of teaching. Pedagogy informs teaching strategies, teacher actions, and teacher judgments and decisions by taking into consideration theories of learning, understandings of students and their needs, and the backgrounds and interests of students.

Subject-specific CPD: Programmes and activities focused on updating and enhancing teachers' understanding of their own subject areas and how to teach them or on developing a teacher's ability in a subject in which they are less confident but may be expected to teach. This includes CPD with an exclusive focus on specific areas of subject content and associated pedagogic content knowledge, as well as the development of teaching and learning in ways that are contextualised for specific subjects.

Distance and Blended Education

Asynchronous communication: Communication in which time typically elapses between when a message is sent and when it is received. Examples of asynchronous communication include letters, bulletin boards, email, and discussion forums.

Blended learning: In distance education, an instructional approach that blends or combines face-to-face instruction with some form of distance-based or technology-based instruction (online courses, radio-based instruction, etc.). Blended learning is also called 'hybrid learning'.

Distance learning: A system and process that connects learners to distributed learning resources. Distance learning can take a variety of forms, but all distance learning is characterized by (1) separation/distance of place and/or time between instructor and learner, amongst learners, and/or between learners and learning resources; and (2) interaction between the learner and the instructor, among learners, and/or between learners and learning resources conducted through one or more media.

Social media: User-created media (video, audio, text, or multimedia) that are published and shared in a social environment, for example, a blog, wiki, or video hosting site. Examples include YouTube and Flickr.

Synchronous collaboration tools: Web-based technologies that allow for real-time or synchronous communication—for example, text chat, audio conferencing, videoconferencing, VoIP telephony (such as Skype), and multi-user domain, object-oriented environments (MOOS).

Adapted from on Cordingley et al. (2018, p.32) and Burns (2011, p.275)



Literature Review

Effective Continuing Professional Development and Learning

What does the research tell us are the key elements of effective Continuing Professional Development and Learning (CPDL) that make a difference to pupils as well as teachers?

Whether teacher education is supported face-to-face, online or through a blend of both modes of activity, it is important for us start with some clarity about the key elements of success likely to be important which will apply to all modes. We there consider in this section the principles for effective continuing professional development and learning (CPDL) and then additional considerations and differences for initial teacher education.

The reasons are twofold for starting this review with a summary of the literature on effective teacher education: first, this provides background information for the subsequent sections that we can refer back to; second, and more significantly, is that we hold that understanding effective remote and online teacher learning requires one to apply what is already known about effective teacher education to a new space, and while utilising new technologies (Quinn et al., 2019). In other words, we should not be confusing the medium (and the structure) for the message. Whether online, face-to-face or a blend of these, teachers must go through a familiar set of thinking and practice development processes. The subsequent question is what these processes 'look like' when using new technologies and through new media. Insofar as there are separate principles for effective blended and remote teacher learning, they will relate to how we can employ new approaches, mitigate their limitations, and realise their affordances in recognition of the more general set of teacher learning principles.

In Box 2, below, we provide an overview of the principles for effective CPD, CPDL leadership and then initial teacher education. Key reviews sitting behind these principles include those conducted by Cordingley et al. (2015, 2018, and 2020), led by the Centre for the Use of Research and Evidence in Education (CUREE). We have also consulted several other reviews of effective CPD, all with their own foci in areas of teacher education, locations and review methodologies. The full set of professional development-focused reviews is included in the review references in Appendix 2. Of particular note in terms of both quality and recency are the Darling-Hammond (2017) review, assessing studies employing experimental or quasi-experimental designs for teacher development; the Rogers, Brown and Poblete (2020) systematic review focusing on professional learning in early years of education; and the meta-analysis from Hill et al. (2020) that briefly summarises effective professional learning in relation to STEM-focused programmes in particular. The latter is a study with results meeting the present review's inclusion criteria and therefore we also return to this in a later section.



Box 2 – Overview of Principles for Effective CPD and its Leadership

Summary of Research on Key Elements of Effective CPD

- **Pupil orientation** – organising CPDL around colleagues’ aspirations for pupils including outcomes
- **Diagnostics** – identification and understanding of teachers’ starting points (professional identities practices and motivations, beliefs, approaches to learning, existing knowledge and skills and beliefs)
- **Differentiation** – tailoring of learning experiences to teachers’ starting points
- **Theory and practice** – emphasising practical theory alongside content and pedagogy
- **Collaboration/peer support** – ensuring this originates from iterative trialling and testing of new approaches and evidence about how pupils’ respond to accelerate trust, deepen ownership, and refine practice
- **Specialist expertise** – mobilising and integrating deep knowledge regarding CPD content, pupils, and community to provide expert support and challenge via:
 - Challenging of orthodoxies
 - Illustration of practices from other settings
 - Securing depth in learning via evaluation and design of CPDL activities
- **Contextualisation** – ensuring content is contextualised for each subject but also for sub-groups of pupils – generic pedagogic CPD does not work on its own
- **Experimentation** – effective CPDL involves carefully aligned sustained, iterative experimentation
- **Duration** – iterative experimentation needs to be sustained over time to allow for gradual assimilation, testing and refinement. Short term CPDL can work for very tightly specified approaches to particular aspects of teaching for very specific stages in learning (e.g. spelling of a subgroup of words). Time is required to incorporate results into practice

Selected Summary of Research on Key Elements of Effective CPDL Leadership

- **Positioning CPDL** as shared responsibility for pupil achievement and wellbeing
- **Focussing** on teachers’ professional growth as well as developing knowledge/skills
- **Modelling openness** to professional/leadership learning
- Designing **structures/systems for managing complexity** taking fully into account the cognitive, practical & emotional demands made by CPDL approaches and systems

In narrative form: the evidence on effective professional development and learning indicates that carefully designed teacher CPDL, closely aligned with specific aspirations for pupil outcomes has a significant impact on student achievement. To be most effective, CPDL programmes that aim to bring about significant organisational and cultural change need to be sustained over at least two terms and involve multiple, iterative activities to experiment with and refine approaches introduced though initial input for context. It is important that CPDL programme design creates a ‘rhythm’ to professional learning activity, through multiple instances of ongoing support/follow-up activities. An essential element of successful CPDL is overt relevance of content to its participants and their day-to-day experiences and aspirations for pupils; collaboration between peers is important to encourage risk taking with new approaches and achieving a shared sense of purpose. This needs to be rooted in unpacking evidence about how pupils are responding to changes teachers make. Access to specialist expertise is key to success and, in particular to challenging/enabling teachers to explore existing



beliefs and assumptions, understanding what success can look like and developing an underpinning rationale or practical theory about new approaches to help them adapt approaches for specific subjects, or groups of pupils: generic pedagogic CPDL that does not support such contextualisation is not linked with pupil success. A positive professional learning environment, the provision of sufficient time (quantum and elapsed), and consistency between the professional learning experience and the wider social and educational context were also significant. Finally, the reviews highlight the importance of identifying teachers' starting points and of formative assessment and pupil outcome-oriented learning processes and outcomes for teachers within effective CPDL programmes.

What should be stressed in relation to **pupil orientation**, in particular, is that both providers and participants take the time and effort to be clear and specific about what the participants' pupils' learning will look like if the CPD is successful and to design and select activities on that basis. Also noteworthy is that one of the biggest practical challenges facing CPD providers is the huge range of starting points in relation to skills, knowledge, expertise and beliefs of the participating teachers, which inevitably makes **differentiation** demanding – and expensive (see Cordingley et al., 2018). Approaches such as structured coaching and action research/ enquiry can do a great deal to bring to the surface these starting points. **Diagnostic activities** that take a great deal of time face to face can be made more effective and efficient with the support of technology through, for example, use of annotated video or online surveys.

At this point, we pause our discussion of effective CPDL, but will continue to the principles enumerated in Box 2, above, as we discuss remote and blended forms of teacher learning.

Effective Initial Teacher Education

What does the research tell us are the key elements of effective Initial Teacher Education (ITE) and how does it differ to CPDL?

Effective initial teacher education to a large extent aligns with the above. But there are important differences and additional considerations to consider as Hargreaves (1993) points out in his 'Practical Common-sense model of teacher development'. For example, pre-service teachers need rapidly to develop a body of knowledge and set of practical skills about the business of teaching and learning and to integrate the two within classroom contexts as well as with their specialist knowledge and skills. Indeed, the DfE (2019) ITT Core Content Framework, used alongside the DfE (2020) Early Career Framework and the DfE (2011) Teaching Standards, sets out the content required by pre-service teachers irrespective of subject or phase. The statutory requirements (DfE, 2019) include 62 key evidence statements, 'Learn that...', drawn from 'current high-quality evidence from the UK and overseas' (p.4) and informed by the 'best available educational research' (p.10).

ITE providers must manage the **risk of knowledge overload** – but also can build upon widespread recognition that there is a need to explore a large canvas. But for those supporting experienced teachers there exists an extensive iceberg of knowledge and skills that has can be deployed rapidly in classroom settings. Those



supporting CPD need to find ways of helping teachers to surface¹, review and refine this knowledge base in the light of new approaches and evidence. ITE pre-service teachers and beginning teachers are faced for the first time with large numbers of unknown pupils who interact dynamically with each other and who know each other and their school much better than pre-service teachers do. Some pupils are also developing their own independent identities and doing so through experimenting with risk, often linked with challenging behaviours. In this context pre-service teachers are understandably very focussed on establishing their authority and **developing their ability to orchestrate effective behaviour**. Education providers of all kinds, including mentors, can be confident that pre-service teachers will be keen to focus in depth on addressing pupil behaviour and marshalling content, whilst established teachers in contrast may be troubled and possibly threatened by an invitation to revisit practice in these areas, even where new and more sophisticated strategies are possible.

ITE providers need to ensure they 'carefully craft coherently sequenced curricula that meet the particular needs of their trainee teachers, including the foundational knowledge of what subjects and curricula are', (DfE, 2019, p.6). Then gradually and over time pre-service teachers are able to expand their **circle of attention** to focus on the content of what they are teaching, the extent to which their pupils are learning this, the way in which one area of learning connects with another, what their pupils learn in other subjects or phases and the needs and strengths of the community they are serving. Therefore, education and professional development for pre-service teachers needs to span a very wide 'curriculum' and providers can be relatively confident that pre-service teachers will not already have encountered many of the skills and much of the knowledge they need to acquire. By contrast, CPD providers will almost always be working with colleagues who have encountered many of the ideas and approaches they are introducing but in a different form or under different labels or in different contexts. Similarly, they will be working with colleagues who have built their professional identity and authority, for whom change may mean a degree of unlearning and certainly the taking of significant risks in leaving aside established routines. In this context, challenge and sensitivity coupled with a commitment to surface colleagues' prior knowledge and skills in ways that are respectful as well as helpful in enabling review and reflection are of prime importance. Finally, it is valuable to note that most initial teacher education pre-service teachers are also new to the **world of work**, bringing additional areas for new learning including in relation to professional conduct, management and organisation and the social and personal norms of participating within the school and wider community.

¹ A great deal of teacher knowledge is tacit knowledge, built up over time with training and classroom experience. This tacit knowledge is ingrained and its application in classroom situations 'automatic' (i.e. not, or only partially consciously attended to). As a result of this, part of the job of refining and developing teacher knowledge it is to '(re)surface' it, making it explicit and the object of conscious attention, so it can be re-considered and refined. For example, a teacher might be asked to watch a video of themselves teaching, the video paused and the teacher asked about significant features of the classroom environment and why they did A, rather than B, in the given situation. See Sherin and Van Es (2009) for a discussion of the use of video club participation to develop 'professional vision' (also Perry et al., 2020). More generally, the issue of tacit knowledge in continuing professional development means that there is a need to revisit and in some cases 'unlearn' practice as much as the need to develop new ones (in contrast to initial teacher education where much of the learning is being approached for the first time).



In overview, and in addition to the principles for effective continuing teacher education, ITE accentuates the following particular principles:

Box 3 – Overview of Additional Principles for Effective ITE (as compared to CPDL)

Summary of Research- and Expertise-based Principles for Effective ITE (As compared to CPDL)

- ***Managing Overload*** – balance the need for explicit, detailed instruction and the need to meet statutory expectations with avoidance of overload, helping pre-service teachers focus on the fundamentals of practice
- ***Foundational Curriculum*** – provide an especially coherent and well-sequenced curriculum that covers all foundational knowledge while meeting individual needs of pre-service teachers, allowing pre-service teachers to acquire and refresh a significant body of subject content knowledge (ck), pedagogical knowledge (pk) and pedagogical content knowledge (pck) in tandem, exploring how these come together and their relation to pupil needs and learning
- ***Grounded Instruction*** – providing well-illustrated, contextualised instruction and the opportunities and skills to closely observe practice and develop as reflective practitioners
- ***Manage risk and develop self-efficacy*** – helping pre-service teachers manage uncertainty and seek expert (including mentor) support, accessing the practical wisdom and reasoning of experienced teachers, and understanding how this relates to their own developing expertise (Twiselton, 2016), situating themselves in and contributing to supportive professional learning environments
- ***Orientation to Professional Identity and Community*** – consider the implications of students typically being new to the world of work, professional working and school communities, supporting students to adopt a range of roles within a professional learning environment, begin the development of a holistic professional identity that fosters professional learning (of themselves and others), and advances and critically reflects on educational purposes and values of their communities and more widely
- ***Organisation of the curriculum to ensure*** content and aims are sequenced and prioritised to fit the training timescales, structure, statutory and non-statutory requirements of teacher preparation, and particular learning and practice settings



Remote and blended Teacher Education Modes and their Characteristics

Q1. What forms of/approaches to remote or blended teacher education have been explored in the research literature? What are their typical characteristics/elements? How can this be organised?

We now move to the portion of this report where we address our research questions, as set out above, in relation to the literature we have reviewed. Our first question relates to what approaches are evident in the literature and, presumably, also in common practice. Our aim here is to produce a functional framework, accompanied with some brief descriptions and illustration, to identify categories and key concepts that can be used throughout the review to support alignment and discussion of effective teacher learning principles with remote and blended teacher education approaches. We have not had the time nor resources to be systematic or comprehensive in this particular portion of the review, nor to step systematically through the empirical and review papers on which we have drawn. What we offer is a connoisseurial summary of what we found.

A Working Framework of Remote and Blended Teacher Education Modes

Based on our review database, we have developed the following simple framework of remote and blended teacher education modes. Whether these can accurately be described as modes, or whether we need to distinguish approaches, components, or media (for example) is not a question we pursue here. We simply note that, evident in our review database (as reviewed below) are numerous different approaches and characteristics of remote and blended teacher education approaches and variants and combinations thereof. Within these modes, there are clear links to be made in terms of overlap and modes which are typically combined (in particular between modes 2 and 3, and 4 and 5).

We have identified *six general modes of online or blended teacher education*:

- 1. Lectures, workshops, seminars, discussion groups or conferences**, including one-off sessions and series
- 2. Coaching and mentoring**
- 3. Classroom observations with feedback and/or discussion**
- 4. Resource bases or repositories**, with varying degrees of user interaction and content creation.
- 5. Platforms and self-study programmes**, ranging from less to more structured programmes that give access to curated/designed resources, learning content, assessments and/or directed activities to learners
- 6. Virtual reality spaces or simulations**

While these categories capture common types of activity, a large variation exists within and across these broad groups. So we have also identified several cross-cutting factors that characterise teacher education in the modes listed above.



Cross-cutting factors we found to characterise these modes are:

- i) **(A)synchronicity** – With most of the above, it is possible to design asynchronous, synchronous and mixed variants. The advantages of each of these is discussed below.
- j) **Interactivity** – Teacher education varies within and across programmes in the opportunities for interaction versus passivity, and the extent to which teachers are placed as consumers or producers.
- k) **Community** – Programmes can be designed to be more or less collaborative, many seeking to form or situate activity within ‘**Professional Learning Communities**’ (PLCs). We note that other frameworks (e.g. Little and Housand, 2011, see below) have PLCs as a mode in their own right. To our mind, the extent to which teacher education is an individual affair or part of a community is a more cross-cutting question (i.e. PLCs operate across modes rather than being a mode *per se*).
- l) **Choice of (Multi-)media** – In remote and online teacher education programme design, there is often a choice to be made between the use of video, audio and/or text as a medium of expression, for discussion or to convey information. Teacher education designers are now able to choose from several media and are typically opting for multimedia approaches. Moreover, as technology has improved, the inherent benefits of the media can be foregrounded in decisions, rather than the practicalities (e.g. cost and convenience) of the technology.
- m) **Combining Elements** – Many programmes combine the overall modes, e.g. provide an online seminar followed by remote coaching. This is worth considering in relation to affordances below, that programme elements can be combined to ensure ‘coverage’ of teacher learning aims and principles and allow each medium and element to ‘play to its strengths’.
- n) **Structure, design and facilitation** – Programmes vary in the extent to which they have been actively designed (as opposed to spontaneous and ‘crowd-sourced’) and the extent to which the activity is actively kept to this design through facilitation, direction (in person or through technology and activity timings and content). There are also more general organisational issues around the number, length and timing of programme inputs. While these may feel prosaic, as we discuss further below, these can have a significant impact on the impact of the teacher education and affordances around blended modes and activities.
- o) **Providers/Partnerships** – One other consideration is about the provider(s). Many teacher education programmes were delivered and/or designed by a combination of one or more teacher groups, schools, universities, and/or local/national authorities working in partnership.
- p) **Focus and purpose** – A final key area of difference apparent in the literature is the extent to which teacher education in different modes is focused on/centred around a practical purpose (e.g. increasing STEM participation), by identity (secondary biology teachers discussion groups) or with a curricular/learning focus (learning and applying the principles of cognitive science).

We have created this two-part typology (modes–characteristics) both from and to structure this rapid review, but we do not claim that it will necessarily map on to other and/or more wide-ranging sets of data/practice, nor do we claim that this is necessarily the most instructive way to ‘cut the cake’ so as to bring key teacher education or practical considerations into focus. We also note that this typology is at a high level of granularity, with little detail on the underlying techniques and technologies (e.g. Bower, 2016 for a typology of specific Web 2.0 learning technologies). At the least, our typology serves the purposes of organising this review. We have compared this to other similar frameworks, with which it mostly aligns. Several examples of these are in Table 1, below:

Table 1 – Selected Typologies of Remote and blended Teacher Education from the Literature

| <i>Little and Housand (2011) (as quoted in Elliot, 2017, p.120-121)</i> | <i>Snell et al. (2019) p.210</i> | <i>Horn & Staker, 2011 (as quoted in Burns, 2011, p.70)</i> |
|--|--|---|
| <p>Mode 1 - The first mode of online professional development is accessible websites or online resources.</p> <p>Mode 2 - The second mode of online professional development is technology for face-to-face interaction with audiences in real time.</p> <p>Mode 3 - The third mode of online professional development is professional development supported by asynchronous online discussion.</p> <p>Mode 4 - The fourth mode of online professional development delivery is videoconferencing.</p> <p>Mode 5 - The fifth mode of professional development is constructing and facilitating an ongoing online community</p> | <p>(1) Remote, non-live, asynchronous coaching consists of coaches who work with teachers remotely, including via video sent by teachers to coaches, and phone or e-mail exchanges between coach and teacher about the content.</p> <p>(2) Remote live coaching consists of coaches observing and providing feedback to teachers live, using webcams.</p> <p>(3) Online course content allows teachers to access online materials and read about [curriculum content], watch videos, and take quizzes.</p> <p>(4) Online group courses or satellite courses are similar to standard PD, except that teachers attend a viewing of the PD programme offered online or over satellite with other groups of teachers.</p> <p>(5) Online downloadable curriculum or lesson plans consist of resources available online for teachers to use in the classroom.</p> | <p>1. Face-to-Face Driver Model: The face-to-face teacher delivers most of the curriculum and uses online materials to supplement. This model often occurs in a computer lab.</p> <p>2. Rotation Model: Students rotate equally between face-to-face and online components of the course on a fixed schedule. They have the same teacher for each component. The online component occurs remotely.</p> <p>3. Flex Model: The online component delivers most of the information, with an in-class teacher present to provide flexible support as needed. This model includes lots of individual and small-group, face-to-face tutoring.</p> <p>4. Online Lab Model: The online teacher delivers the course in a brick-and-mortar classroom, but with paraprofessional or teacher aides supervising students.</p> <p>5. Self-blend Model: Individual students take online courses à la carte. Online learning is remote, but traditional instruction is brick-and-mortar.</p> <p>6. Online Platform Model: Instruction and materials are all online, with students taking the course remotely. Weekly check-ins with a face-to-face supervisor or teacher are required.</p> |

Selected Examples and Illustrations

In this section we discuss and provide selected illustrative examples of remote and blended teacher education approaches, in line with our framework and drawing on the literature we have reviewed. For online initial teacher education, Dymont and Downing (2020) provide an up-to-date and systematic mapping of the literature. This literature is replete with varied examples of practices in online ITE; indeed, as the review authors find in their first theme in the literature, over three quarters (n = 381) of the 492 papers they reviewed profiled an online pedagogical ‘innovation’. As they describe:



“There was a wide diversity of synchronous and asynchronous innovations researched including, but not limited to, web conferences, discussion boards, chat rooms, instant messaging, digital games, social media, virtual laboratories, virtual simulators, discussion boards, portfolios, and Facebook. The papers typically described the technological innovation, the ways in which it was used in ITE courses, and the affordances the technology offered the ITE student or teacher educator.”

(Dyment and Downing, 2020, p.326)

As per their third theme, a small number (14%) of articles profiled how the approach had been contextualised in specific subjects or curriculum areas. The focus of most of these papers was:

“...less on a particular technological innovation and more on the ways in which it was ‘possible’ (or not) to teach these discipline areas online. The papers profiled the challenges, tensions, barriers, opportunities, and affordances for both ITE students and teacher educators when traditionally experiential subject areas are taught in the online space.”

(ibid. p.327)

Having located this systematic review, our aim is not to unpack these studies to the point of providing further elaboration on the details of innovations and practices. Instead, we refer the reader to the Dyment and Downing (2020) review and the papers therein. For rich examples and discussion of online professional development in STEM subjects, we refer the reader to Dede et al. (2016), which – as well as case studies of programmes – contains detailed discussion of literature and practice around online teacher education.

In the remainder of this section we describe each of our modes. We have identified several reviews and case studies that allow us to give an overview and illustrative examples. We note that we are not advancing any of these as examples of *effective* teacher education, rather they are just examples of programmes that fall within our typology and allow us to explore characteristics, variations and issues of the modes before the next section where we consider remote and blended teacher education and the principles for effective teacher education side-by-side.

Mode 1 – Lectures, workshops, seminars, discussion groups or conferences

Our first mode for blended and remote teacher education consists of approaches that facilitate dialogue between a teacher or pre-service teacher and other teachers, pre-service teachers, instructors, experts, stakeholders, or a combination of these. Typically, these approaches combine dialogue and have a (somewhat) defined focus or content. However, at the boundaries of this are: firstly, lectures, which can often include minimal dialogue and are therefore more akin to video content on platforms and self-study programmes (see mode 5); second, conferences, which typically combine numerous elements only some of which resemble a seminar or discussion group. When it comes to conference keynotes and presentations, where the information flow is one directional, these may be thought of as being more similar to static content and our content platform mode (5); when it comes to unstructured discussion between conference delegates, this can have the qualities of more informal professional learning communities (a cross cutting characteristic); for conference question and answer or discussion-focused sessions/periods, we feel these have a great deal in common with seminars and workshops, sharing the characteristic of facilitated discussion that we have identified for this mode.



This point about varying interactivity and structure within conferences is one theme discussed in Seddon et al. (2012), who present a model of web conference activity over the course of the conference in terms of their level of social interaction, information provision, internalisation of information by participants and co-construction of knowledge. They find, in short, that: 'Social interaction was most noticeable at the beginning of sessions then tailed off as the presentations started, but reappeared at the end, as networking for the future occurred' (p.445). The more general point, applying across all modes, is that the amount of discussion, and information presentation is variable both across and within modes, but even within individual units or sessions in a specific approach.

As we touch on above, as technology has improved, teacher education providers are increasingly able to choose the medium/media of expression according to what is effective and desirable rather than what is practicable. For example, and of particular note, is that in recent years it has become increasingly possible to enhance teacher education through interactive use of video to support observation, discussion, modelling, mentoring and coaching. Recent developments in technology have enabled synchronous, video-based small group activity within larger group workshops. This is an important new affordance that has been widely used during Covid-19 lock-down, for example, to enrich peer support and differentiation but is unlikely, as yet to feature in the research. There are, however, numerous examples in the research of the use of video for remote seminar/workshop or conference discussion. One extended discussion of this practice in connection with video conferencing in Burns (2011) is provided below. We note the date (2011, discussing a network operating in 2001-2002) and the discussion of technological as well as teaching and learning considerations.

"Videoconferencing is a powerful distance education option since it approximates face-to-face interactions at a distance. The Canadian province of Alberta uses videoconferencing extensively as a mode of distance learning for teachers. In professional development projects like the U.S.-based Teachers' Telecollaborative Network (2001–2002), teachers in one location collaborated in group-based activities with teachers in another. Teachers were able to see their colleagues and instructors remotely, discuss topics with them at length, participate in learning experiences that might otherwise have been inaccessible, and view live examples of the types of instruction they should and should not be doing. Since teachers can hear and see one another and observe important nonverbal cues (like gesturing) and tonal cues, there is evidence that videoconferencing can mitigate many of the misunderstandings that emerge in online learning. But teaching a remote audience via videoconferencing is still not the same as teaching a 'live' audience. There are often lags in audio; picture and audio quality may be poor; it may be difficult to see all remote learners (or for remote learners to see the instructor); video can drop, leaving remote learners stranded; it may be hard for the videoconference teacher and remote teacher to coordinate activities and timing; certain activities work poorly or not at all across distance; and videoconferencing, like television, often doesn't capitalize on the benefits of the medium, instead defaulting to 'talking head' instruction. Finally, if the video conferencing instructor is working with both a live physical audience and a remote audience, he or she may focus on the live audience to the exclusion of the remote audience—or vice versa."

(Burns, 2011, p.43)

Another key consideration for lectures, workshops, seminars, discussion groups and conferences is whether these are one-off events, part of a series and/or linked to other forms of activity. The hallmark of activity within this mode is to structure discussion around focus questions or content. Decisions around the number



of sessions, their duration and timings shape how long the ‘conversation’ can continue, and the depth and quality in which the questions/content can be considered. Choices around frequency and timings also affect who can participate and the extent to which other teacher education activities can take place between the sessions. A seminar series spread across a school term, for example, allows classroom and other teacher education activity to occur alongside the series and links to be made between these. A conference – even if the questions, content, and opportunities for discussion remain the same – is harder to integrate with other activity in this way.

Mode 2 – Coaching and mentoring

Relative to other modes discussed here, coaching and mentoring are relatively well-defined (and have a strong evidence base finding substantial impacts on teacher learning and pupil outcomes (e.g. see Kraft, Blazar and Hogan, 2018), although practice and quality varies considerably (Hill et al., 2020). The National Framework for Mentoring and Coaching² describes and explains the principles, concepts and skills for mentoring and coaching and compares the overlaps between these (also see Cordingley, and Buckler 2012, and the volume in which it sits: Fletcher and Mullen, 2012). The main difference between remote coaching and mentoring and face-to-face variants is simply that remote versions of coaching and mentoring must use video, audio or textual media to facilitate exchange between the coach/mentor and coachee/mentee. The media ostensibly vary in their suitability and affordances to sustain high quality mentoring and coaching conversations and to the degree they enable synchronous and asynchronous conversations. As this question is common to remote forms of discussion more generally, we pick up this discussion when examining teacher education principles (Q2) and the small amount of evidence for blended coaching/mentoring of teachers (Q3), below.

Mode 3 – Classroom observations with feedback and/or discussion

Closely linked to mentoring and coaching is the observation of classroom teaching. We have included this as a separate mode as video technology allows discussion of classroom teaching in other forms of teacher education, including in discussion groups or on online repositories. So much so that one might argue that rather than being a mode in their own right, classroom observations with discussion and feedback are simply the content for other forms of interaction. Be this as it may, given the centrality of observation of classroom practice to many forms of teacher education and the growing possibilities for (synchronous and asynchronous) observation of classroom teaching afforded by developments in video technology and platforms, we have categorised classroom observation as a mode in its own right.

² <http://www.curee.co.uk/resources/publications/national-framework-mentoring-and-coaching>



The literature on the use of classroom video for professional learning is summarised and discussed in Perry et al. (2020); a short summary of selected points from this is provided below, along with an example. Perry et al. provide an overview of key affordances of video observations for enabling and enhancing CPD, based on reviews in the literature (e.g. Brouwer, 2011; Gaudin & Chaliès, 2015; Major & Watson, 2018):

“First, video is able to vividly capture classroom interactions, allowing them to be carefully reviewed outside of the classroom (Brouwer, Besselink, & Oosterheert, 2017, p. 61; Pehmer, Gröschner, & Seidel, 2015; Tripp & Rich, 2012). Second, this ability to capture and revisit classroom practice lends itself to collaborative approaches to professional development: it becomes feasible for many colleagues and/or external experts to offer different perspectives on videos and jointly learn (Brouwer et al., 2017). Group discussions of video evidence may help teachers to see things they would otherwise miss, creating space for conceptions to change (Gaudin & Chaliès, 2015). This idea has featured prominently in the literatures on ‘Lesson Study’ (e.g. Lewis, Perry, & Murata, 2006) and ‘Learning Study’ (Davies & Dunnill, 2008; Holmqvist, 2010). Third, online video platforms provide opportunities for teachers to prepare for discussions and for colleagues to observe the lessons of others at their own convenience and outside of teaching hours, avoiding supply cover costs (Quinn et al., 2018). Repeat viewing of videos allows for greater efficiencies still, as particularly instructive videos can be viewed by a potentially unlimited number of teachers far removed from the original lesson. Finally, use of classroom videos through video platforms typically allows for additional functionality through the use of video tools, such as editing or annotation tools, which support teacher reflection, discussion and analysis (Rich & Hannafin, 2008).”

(Perry et al. 2020, p.2)

Running through these points one can see the connection with: external expertise and perspectives; discussion groups; enquiry and action research approaches; and platforms – hence our point above that this may be thought of as an activity within more than a mode of teacher education. Questions that arise from this literature include whether it is of greater impact to review one’s own teaching, or that of others (including colleagues or experts). When this was systematically studied the answer seemed to be ‘both’:

“Van Es (2012) and Borko et al. (2008) have argued that teachers will be more open to new ideas when viewing the work of others. Kleinknecht and Schneider (2013) reported greater teacher engagement in analysing ‘problematic events’ when reviewing videos of other teachers. Nonetheless, two systematic comparisons of different combinations of teachers reviewing videos of their own teaching and the teaching of others (Beisiegel et al., 2018; Seidel, Stürmer, Blomberg, Kobarg, & Schwindt, 2011) have reported greater benefits for a sequence of first watching selected videos of others and then reviewing their own teaching.”

(Perry et al. 2020, p.4)

Another question that emerged related to facilitation and structure for observation. The evidence here (p.3) was not clear-cut and alternatives to in-person facilitation are being examined in the literature (e.g. see Brouwer et al. (2017), who reported a positive impact compared to a control group on targeted teaching behaviours when teachers used structured viewing guides in their review of videos.)



The substantive programme evaluated in Perry et al. (2020), and described in some detail, is a professional development programme based around 'video-clubs' and an online platform with content and activities relating to dialogic teaching and feedback³. Interested readers can consult the paper for further details.

We close this section with a short further example of the use of classroom observation via video for professional learning provided by Jamil and Hamre (2018). An interesting angle taken in this study is to examine the online professional development in relation to principles of learning from cognitive science. The programme takes a structured approach to teacher reflection asking teachers to observe, analyse, assess and plan, which the authors discuss in relation to cognitive science principles. In relation to observation, they draw attention to the value of videos for identifying specific, situated interactions and opening these up for conscious consideration, examining what are often tacit and unconscious decisions based on automatic schema, making them explicit again (p.228). They continue:

"Once teachers have made observations, we ask them to analyze the classroom interactions that have taken place by considering the ways in which their choices affect the children in the classroom. This step is important for helping teachers to see the specific consequences of their actions and use them as the criteria for determining effectiveness or ineffectiveness, instead of emotional reactions to situations (Preston, Campbell, Ginsburg, Sommer, & Moretti, 2005; Sherin & Van Es, 2007). If we return to the teacher reflection example that we started with above, we can see how after making her precise observations regarding the effective and ineffective interactions in her video clips, the teacher proceeds to make an honest appraisal of the consequences of these interactions for her students."

(Jamil and Hamre, 2018, p.229)

Evident here, and in the authors' discussion of the assessment stage is a focus on how teaching strategies were experienced by and affected pupils. As a pupil orientation is a principle of effective teacher education, this is a point to which we return below when discussing modality and teacher education more generally. Finally, Jamil and Hamre (2018) outline the value of linking planning to 'critical cues' (p.230) from videos and how this may increase the likelihood of connecting in long term memory to specific classroom situations and promote changes in practice.

In overview, videos of classroom teaching provide teachers with 'objects to think with' (p.74), which connect in a concrete and authentic way to teacher's practice. Use of classroom videos is widely held to hold promise for effective professional learning. The evidence base, however, is not yet sufficiently developed to either support or refute this perception. Returning to the opening point in this section, observing and discussing practice may be more of an activity than a mode and framework for doing so, such as that provided in Jamil and Hamre, and considerations around the promise of video and questions around best practice in Perry et al. (2020) appear to have more general resonance across our teacher education modes.

Mode 4 – Resource bases or repositories

Another mode that has not sat easily as a stand-alone item in our typology is that of resource bases or repositories. Arguably, simply providing access to a resource base should not even qualify in its own right as a form of teacher education. Again, we are left wondering whether resources bases are better thought of as

³ Also see <https://www.irisconnect.com/uk/>



being content or curricula for teacher education rather than types of it. Although we observe that many view curriculum materials as ‘an important source of teacher professional learning in and of themselves’ (Hill et al., 2020, p.52). This question aside, there are numerous examples of resources bases which – to varying degrees – encourage teacher collaboration and professional learning through creation, discussion and use of resources ranging from lesson plans and curriculum schemes of work to worksheets, ideas, stimulus material and assessment tools for use in the classroom. The Times Educational Supplement (TES) teaching resources page provides over 900,000 resources made by teachers, sorted into curriculum areas and topics, with the option to review resources and join in with over 250,000 discussion threads in the community section. More recent examples include Teacherly, which emphasises to a greater extent the collaborative and professional learning aspects of resource creation and sharing, as well as providing a platform for remote teaching. Similarly, linking with the previous section, is that there are examples of resources bases which include classroom videos, such as that investigated in Bates, Phalen and Moran (2016), which at the time they were writing housed over 350 video clips used by over 37,000 members. As noted by Dede et al. (2016), resource collections can also include tools and apps; also, as groups get large, ‘crowd sourcing’ even specialist, topic or subject-specific resources becomes more viable. Members of the review team are increasingly seeing schools and groups of school developing their own approaches to collaboration and sharing of resources (such as using software such as SharePoint, Google Drive and other similar platforms). Before moving on, we note the parallels here with the questions that arise in relation to PLCs (below) relating to quality control, depth of engagement and participation.

Mode 5 – Platforms and Self-study Programmes

Many programmes we have reviewed are based around an online learning platform, or virtual learning environment. This is the area that is most varied in terms of content, activities (and apparently quality) and there are many points of contact with other modes. Indeed, it is possible to describe most online platforms for teacher education as being a curated, structured resource base (often with added instructional material) with wrap around collaboration and expert input in the form of seminars, mentoring, discussion groups and or (less commonly) lesson observations. Moreover, where a platform and its associated activities bring together teachers and pre-service teachers for discussion, sharing and support, it can be said to be an organisational focal point for a PLC. In short, teacher education online platforms and programmes which use them can and often do incorporate one or more (other) modes of teacher education. Typical examples include Dana et al. (2017) who provide a detailed description of the Prime Online programme, a year-long programme designed to develop subject (pedagogical) content knowledge and pedagogical content knowledge in mathematics elementary (primary) classrooms through practitioner inquiry. They describe the programme as follows:



“The Prime Online experience was organized into three distinct, yet integrated, segments of weekly modules consisting of content and experiences designed to build on one another over the year-long program. An online learning software program, Moodle™ (Dougiamas 1999), was used to design and deliver the 35 modules for general and special education teachers teaching struggling mathematics learners in the third through fifth grades. Each module included a consistent format with four components: Introduction; Anticipatory Activity; Content and Discussion; and Classroom Connections.”

(Dana et al., 2017, p.215)

They continue:

“When teacher participants logged into the online site at the start of each week, they first encountered the Introduction including an overview for the week’s activities, goals, objectives and references for materials needed to complete learning tasks. The Anticipatory Activity was designed to help participants reflect on and connect their prior experiences and knowledge to new content they were about to encounter in Prime Online. In general, Anticipatory Activities consisted of a thought-provoking question asking participants to ponder prior experiences teaching mathematics and/or working with struggling mathematics learners. Frequently, participants were asked to engage with mathematics activities as adult learners to segue to the week’s content. The Content and Discussion section of the module consisted of readings, video recordings, web quests and other activities accompanied by prompts used to foster online forum discussions among participants throughout the week. Finally, the Classroom Connections portion of the module contained an application assignment where participants applied what they learned during the week to their classroom practice. At the end of each week, a facilitator announcement was posted to summarize, analyze and synthesize the participants’ discussions and their collective learning for the week.”

(Dana et al., 2017, p.215)

Dana et al. (2017) go on to discuss the programme, its content and how participants engaged with it in detail. While their focus is more on practitioner inquiry than the affordances of online teacher learning approaches, it nonetheless provides a rich illustration of how online approaches to teacher learning can be designed and implemented. They close the paper with a discussion of the potential for online programmes and what we are yet to fully understand, a passage that links to many of our teacher education principles is quoted below:

“Online PD that incorporates teachers’ study of their own practice is, by nature, relevant and integrated into teacher’s everyday working lives. However, beyond the practical benefits of online learning for teachers (Whitehouse et al. 2006, Dede et al. 2009), further research designed to explore the capacity of online PD programs, like Prime Online, to address teachers’ differing learning needs for content knowledge and support for teacher inquiry is indicated. In addition, answering the call to assess the impact of teacher PD on student outcomes (Desimone 2009) is an important research outlet for online PD programs as well.”

(Dana et al., 2017, p.228)

Although space does not permit us to pursue them further here, other rich examples of programmes in this area are provided in Owston et al. (2008), who review three programme evaluations of blended teacher



professional development and exploring, for example, issues around programme structure and its links to expectations and relevance, as follows:

“There appeared to be a relationship between program structure, in terms of content and online expectations, and relevance. The more structure that a program imposed, the less flexibility it provided teachers to experiment with activities in the classroom at same time they were planning on teaching them. ABEL, for example, allowed teachers to use the project resources whenever they wanted, whereas TeL had a fairly rigid 208 timetable for teachers to complete specified activities. At the same time flexibility seemed to be directly related to online participation. In other words, a highly flexible program like ABEL saw weak online participation whereas the most structured program, TeL, saw relatively strong participation. Therefore, developers of blended programs need to be aware of these trade-offs when designing the overall structure of a program.”

(Owston et al., 2008, p.208)

Based on our limited sample, teacher education programmes established around platforms were often blended programmes – it is widely argued (e.g. Keengwe and Kang, 2013) that blended delivery combines the advantages and overcomes the disadvantages of face to face and online. Keengwe and Kang (2013), based on their review of empirical research in blended teacher education programmes, find evidence that blended approaches have higher student satisfaction, although our review is not in a position to examine whether this is more widely supported in the current evidence.

In sum, learning platforms are clearly performing multiple functions, bringing together and organising teacher education modes, content and activities. 71 out of 89 studies of professional development programmes for STEM teachers reviewed by Hill et al. (2020) for example combined new curriculum materials for teachers to use in classrooms with professional development. Elliot (2017, p.121), in their review, discuss how ‘course management systems’ or ‘learning management systems’, which they define as a ‘collection of online learning tools contained in one system’ can be used to achieve multiple aims, also cautioning against the assumption that conventional face-to-face programmes can be straight-forwardly transferred into the differing dynamics of online environments.

Mode 6 – Virtual reality spaces or simulations

The final mode that we have identified but will not be pursuing further past this brief section is the use of virtual reality (VR) or simulation spaces for teacher education. This includes the use of virtual environments such as the popular ‘Second Life’ virtual world as a space for developing teaching skills or its components and the use of VR to immerse teachers in observation of virtual reality classrooms (i.e. 360 degree videos of real classroom activity).



Burns (2011) describes the use of one popular virtual reality space:

"The 'world' of Second Life is inhabited by people, content, and experiences. Users create 'avatars' to represent themselves and thereby interact with artifacts, take part in a range of educational and social experiences, and create their own content. A growing number of educators have begun to use Second Life to enhance distance learning. For example, many U.S. universities schedule discussion groups, lectures, and office hours in Second Life (Wong, 2006). Educational organizations with teacher-training responsibilities promote ongoing special events, workshops, and informal networking in Second Life, using it to develop ongoing professional learning networks of innovative educators who are seeking strategies for classroom instruction and management... Its immersive, highly synchronous attributes make Second Life a potentially powerful distance education tool that can enhance learner interaction with content and users and allow learners to be 'telepresent' at learning events that would otherwise be unavailable to them. "

(Burns, 2011, p.100)

We refer readers interested in finding out more about virtual worlds to systematic reviews by Theelan, Van den Beemt and den Brok (2019) – focused on interpersonal competence for pre-service teachers – and Billingsley et al. (2019), who systematically examine VR in pre-service and in-service programmes.

When it comes to VR classroom experiences, we feel that many of the affordances and questions linked to the use of classroom video, as discussed above, apply. Like classroom video, VR technology promises the potential for immersive and concrete classroom experience, which when organised around principles for effective teacher education apparently have great potential to support teacher learning.

The review team has little experience in either of these approaches and as they are not yet in widespread use, nor have an associated research literature, we therefore finish our consideration of virtual reality and simulation spaces at this point, but note that these are likely to become features of many teacher education programme in future as programme designers look for authentic and immersive classroom simulation and experience. Whether use of classroom video is effective is, as yet, an open question in the research literature and so whether these more immersive approaches are also and/or additionally effective remains to be seen.

Professional Learning Communities

Before moving on to discuss the affordances and limitations of remote and blended modes, we consider one of the cross-cutting factors in our framework: the extent to which the teacher education programme is delivered within and/or forms a professional learning community (as opposed to individual-level, or small group teacher education). While other cross-cutting factors are discussed in specific sections throughout the report, as PLCs are in other reviews considered a mode and, moreover, raise many common issues around the nature of collaboration, expertise and focus, this area warranted a dedicated section.

Remote and blended professional learning communities have attracted considerable attention from both practitioners and researchers. It is an area of this literature that comprises not only numerous research pieces, including many case studies, but a growing body of meta-analyses, reviews and reports. This is a sign of the growing maturity of both research and practice in this area. This said, what is not evident in the literature (or at least from within our searches) are many examples of attempts to evaluate the impact of online (or indeed any) professional learning communities in terms of their impact on pupils, as opposed to changes in teacher



practices or teacher satisfaction. As we discuss at greater length below, PLCs have evolved for numerous purposes and have not always been well aligned to principles for effective teacher education. While we can provide – via reviews identified in the study – a descriptive and theoretical account, some caution is needed in drawing any conclusions about the design principles for effective teacher education within PLCs.

What seems to be common to PLCs is that they bring groups of educators together around a purpose (e.g. a school improvement initiative) and/or identity (e.g. secondary biology teachers interested in research-informed practice). It is this that motivates our decision to classify PLCs as a factor rather than a mode. PLCs are different in kind from the modes in our typology, which are defined by approaches to exchanging and engaging with information, in contrast to PLCs that might better be characterised as a motivation for doing so or a characterisation of the group involved in the teacher education. PLCs could therefore be a group that meets to observe and discuss teaching (mode 1) or one based around a teacher education programme using a virtual learning platform (mode 5), and so on. Accordingly, PLCs are diverse in terms of their modes of teacher education and more generally.

We identified numerous case studies and reviews focused on online or blended professional learning communities. There was huge variety evident, something that the reviews in the area have also grappled with (e.g. Macià and García, 2016; Lantz-Andersson, Lundin and Selwyn, 2018; Khalid and Strange, 2016). Macià & García (2016) reviewed the principal features and practices of online communities/networks, existing theoretical frameworks and methodological approaches, and the impact of these on the professional development of teachers. They found that the range of online communities and networks for teacher PD is wide and still in fairly early development, the corresponding theoretical frameworks are quite varied and tricky to compare, and that the practical impact on teacher PD is unproven and the mechanics of such impact unclear. Given this uncertainty and heterogeneity, it is perhaps of greater value to draw on the reviews in this area to briefly describe how online/blended PLCs vary rather than attempt to characterise them. We do offer a couple of illustrative examples below this discussion.

Remote and blended professional learning communities vary in terms of (for example):

- Formal or informal organisation (Lantz-Andersson et al., 2018).
- Extent of time commitment desired and achieved by individuals and the combined community.
- The media/technologies employed for PLC activities and discussion. However, much of the research in this area fails to mention or describe the technological basis for the PLC in any detail (Lantz-Andersson et al., 2018, p.305). Technology, particularly in relation to issues of access and technological understanding of potential PLC members, is perceived as a key barrier to participation (Khalid and Strange, 2016).
- Their focus and activities (see below).
- Their size and geographical reach.
- The heterogeneity of the community in terms of their phase, subject expertise and so on.
- The balance of online to face-to-face contact for blended communities.

This list, while far from exhaustive, already casts PLCs as a fairly nebulous concept.

PLCs are often based around teacher professional development and learning through other modes (e.g. a PLC forming around a face-to-face programme, or a conference group). PLCs frequently therefore extend other teacher activity, creating additional opportunity for collaboration, discussion and sharing. They also exist in



their own right, again varied and characterised in part by the above factors. PLCs existing in their own right often centre on sharing and peer support. In their systematic review of formal and informal PLCs, Lantz-Andersson et al. describe the sharing function of PLCs as follows:

"[Sharing in PLCs was] exemplified as a means of filtering large quantities of potentially useful information and drawing on the 'collective mind' of colleagues (e.g., Davis, 2015; Ranieri et al., 2012; Wesely, 2013) thus contrasting with the idea of professional learning as engagement with a limited amount of prescribed information. The filtering characteristic therefore extends the sharing practices described by Macià and García (2016), involving utilisation of the possibilities inherent in social media platforms to sort information. However, it is important to note that any sense of this being an expansive process for participants is tempered by the recurring finding that these communities were often sites for 'superficial' sharing of information, quick exchanges and a 'smash-and-grab' approach to becoming informed. Certainly, further research is required to explore the usefulness of such exchanges."

(Lantz-Andersson et al., 2018, p.311)

PLCs therefore seem to have the strength of being able to go beyond formal, structured and defined teacher education activities and content to provide more bespoke 'crowd-sourced' resources and opinions. We notice an interesting parallel with findings in Morris, Perry and Asquith (2020), where leaders reported using their professional communities and trusted sources and individuals within them as a short-cut to the curation and quality-assurance of strategies and resources. The benefits of additional, bespoke and 'just-in-time' content within discussion and sharing in PLCs is linked in many cases to their *lack* of design, structure and formality in terms of curriculum and activity (but see below); as noted in the Lantz-Andersson et al. (2018) excerpt above, however, the downside of this is the danger of superficiality in engagement for many PLC participants.

We return to this discussion in connection with teacher education principles (and in particular collaboration and expert input) in the section on Q2, below.

Examples of PLCs in the literature include Frumin et al. (2018), who undertook a 5-year longitudinal study of the participation of US high school science teachers in an online teacher community supporting curriculum change. They investigated the College Board's online Advanced Placement Teacher Community (APTC) through which teachers discussed teaching strategies, shared resources, and 'connected' with each other. The study focused on teachers' patterns of usage, the impact of usage on the performance of their students, and how the PLC might harmonise with established programmes of PD. Indeed, this is a good example of an online professional learning community built to extend face-to-face and online courses around a defined curriculum, giving the PLC structure and focus. Capturing some of the possible benefits of PLCs, as discussed above, Frumin et al. describe the nature, organisation and timings of activity in the PLC as follows:



“Although each APTC has a unique moderator, a current or former AP teacher who is paid modestly by the College Board, the online community functions and is sustained by the original interactions, resources, and momentum of AP teachers. In addition, compared to the other professional development offerings, the APTC is the only option that is continuous throughout the calendar year and is accessible 24 hours a day, 7 days a week without a fixed duration or frequency. The others are finite professional development sessions with a one-day, four-day, five-day, or a multi-week span. In addition, most multi-day, face-to-face professional development sessions are held over the summer; whereas APTC participation can happen within and proximate to the school day and school year. In addition to being ‘bottom-up’ and ongoing, the APTC has the following two primary attributes, based on survey and case study data, that complement and extend top-down forms of professional development: 1) personalisation of content and 2) a shared, affective community.”

(Frumin et al., 2018, p.413)

Despite (or perhaps because) of their bottom-up and ongoing nature, PLCs can have issues with engagement levels from all members of the community. Frumin et al. (2018) found that only about half of their survey respondents used the APTC and many of the participants in the online community were what is known as ‘lurkers’ (i.e. individuals who observe but do not actively participate – something we discuss further below). They also find (and this is echoed in Khalid and Strange, 2016) that PLC members can struggle to feel safe (e.g. from criticism or judgement) or able (e.g. technological, cultural or expert knowledge) to fully participate in the community. Some survey respondents in Frumin et al. (2018, p.415) ‘note that the online community does not always feel safe given the employed moderation techniques (or lack thereof) and/or the domination (or bullying) by a few strong voices.’ In their paper on the programme, Frumin et al. also report a degree of positive association of participation with student outcomes, albeit finding little association between student AP scores and the frequency and duration of APTC participation, a finding we return to in our empirical section below. Other rich case studies we have examined in our review include Holmes (2013), who presents a case study of eTwinning professional learning community, and Dede et al. (2016, Chapter 6), who describe a ‘Just-in-time’ professional development community called the ‘Active Physics Teacher Community’:

“The ‘Active Physics Teacher Community’ has the specific intention of helping teachers plan their daily lessons and ‘providing them with formal instruction that is directly related to the lessons they are teaching; share their knowledge, experiences, successes, and challenges with other teachers who are using the same lesson plans and curriculum; and compare the effectiveness of their teaching...”

(Dede et al., 2016, p.162, Chapter 6)

Both of these examples (and of course many other studies besides) surface many of the issues we have raised in this section and continue to discuss below and will therefore be of interest to practitioners or researchers interested in further exploration and illustrations.



Affordances and Limitations of Remote and blended Approaches to Teacher Education

Q2. What are the affordances and limitations of remote and blended teacher education relative to face-to-face variants? What adaptations, restrictions or enhancements are typical relative to face-to-face variants?

We tackle this question from two perspectives:

- A. What, from a theoretical standpoint, can be inferred from the literature on effective continuing professional development and learning (CPDL) and initial teacher education (ITE)?*
 - B. What is advocated as best practice in the remote/blended teacher education literature?*
-

In the literature review (above) we set out principles for effective CPDL and its leadership, as well as some additional remarks and principles that come from the effective ITE literature. In our first question, we described the landscape of remote and blended teacher education, modes within it and their characteristics. In this section we bring the previous two sections together and summarise and analyse the links between teacher education modality and teacher education principles, asking our second research question: *What are the affordances and limitations of remote and blended teacher education relative to face-to-face variants? What adaptations, restrictions or enhancements are typical relative to face-to-face variants?*

It should be stressed that this is an exploratory treatment of the question. Although reviews such as Surrette and Johnson (2015) and several other pieces we discuss below provided an excellent starting point, the literature (even when taken as a whole) did not yield an extended or comprehensive account. So, in what follows we draw on our own expertise as well as the studies and reviews in the review database, where these discuss or present relevant principles and issues. This is an exercise in synthesis and interpretation that is not (unlike our evidence review) based on exhaustive and systematic treatment of relevant studies. Moreover, there is no systematic attempt to tie the below with supporting evidence (beyond that reported in the studies and those with which we are familiar). Our aim is to ‘think out loud’: entertaining and exploring hypotheses and entertaining plausible connections between the effective teacher education principles and the affordances, limitations and practice of remote and blended teacher education. In the empirical sections which follow (Q3) we will look to return to the question of evidential support for themes within this discussion.

We proceed as follows: in Table 2, below, we map the ‘fit’ of the first 5 modes⁴ we have identified above to teacher education principles, both in terms of what we understand of current practice and in terms of potential. While there is huge variation in each mode (and in particular in relation to the cross-cutting factors we have identified), this is a starting point for our exploration.

⁴ Excluding virtual reality spaces, on which we have too little experience and found too little literature

We follow Table 2 with brief points about selected judgements, before a discussion of each principle and how it fits remote and blended teacher education side-by-side with the literature we have reviewed.

Table 2 – A Tentative and Theoretical Mapping of Teacher Education Principles and Mode

| Key | | | | | |
|---|---|-------------------------------|-----------------------------------|---|--|
| 4* Great fit – Perhaps better even than face to face. What technological affordance support this element of CPDL intrinsically support this element of CPDL (GRF)? | | | | | |
| 3* Potential good fit – What technological affordances can easily be used to replicate key elements if used with care to support this element of CPDL? (PGF) | | | | | |
| 2* Potential fit with careful use/ adaptation – What technological affordances can help to support this element of CPDL if adapted and used with care and supported by intermediating tools (PFWC) | | | | | |
| 1* Poor fit/ Unworkable/ineffective – may be possible, perhaps in a limited form | | | | | |
| How Easy is it to Achieve Effective Teacher Education Principles in Different Modes? | | | | | |
| | <i>Lectures, workshops, seminars etc.</i> | <i>Coaching and mentoring</i> | <i>Observations with feedback</i> | <i>Using resource bases or repositories</i> | <i>Platforms and Self-study Programmes</i> |
| CPDL | | | | | |
| <i>Pupil orientation</i> | 2-3* | 3* | 3-4* | 2-3* | 2-3* |
| <i>Diagnostics</i> | 2-3* | 3* | 3-4* | 2* | 2-3* |
| <i>Differentiation</i> | 2-3* | 3-4* | 3-4* | 2-3* | 2-3* |
| <i>Theory and practice</i> | 3* | 3-4* | 3-4* | 2-3* | 2-3* |
| <i>Collaboration</i> | 2-3* | 2-3* | 2-3* | 2* | 2-3* |
| <i>Specialist expertise</i> | 3-4* | 3-4* | 3-4* | 3-4* | 3-4* |
| <i>Experimentation</i> | 2-3* | 3-4* | 3-4* | 2* | 2-3* |
| <i>Duration</i> | 3-4* | 3-4* | 2-4* | 2-3* | 2-3* |
| Leadership of CPDL | | | | | |
| <i>Positioning CPDL</i> | 2-3* | 3* | 3-4* | 2-3* | 2-3* |
| <i>Focussing CPDL</i> | 2-3* | 3* | 3-4* | 2-3* | 2-3* |
| <i>Modelling openness</i> | 3-4* | 3-4* | 3-4* | 2-3* | 3-4* |
| <i>Managing complexity</i> | 3-4* | 3-4* | 3-4* | 2-3* | 3-4* |
| Initial Teacher Education | | | | | |
| <i>Manage overload</i> | 3-4* | 3-4* | 3-4* | 2-3* | 3-4* |
| <i>Foundational Curriculum</i> | 3-4* | 3* | 3* | 2-3* | 3-4* |
| <i>Grounded Instruction</i> | 2-3* | 3* | 4* | 2-3* | 2-3* |
| <i>Manage risk</i> | 2-3* | 4* | 3* | 2-3* | 2-3* |
| <i>Professional Orientation</i> | 3-4* | 3-4* | 3-4* | 2-3* | 3-4* |

Our opening reflection on the (admittedly ambitious) task of completing this mapping grid is that remote and blended teacher education is a broad church. Our own experiences and the accounts of many of our review studies tell us something about a programme, but not about the modality in general. There is huge variation in practice and the technologies employed with each mode. We are reminded of the so-called ‘Bananarama



Principle⁵ that, ‘it ain’t what you do but the way that you do it: that’s what gets results’. Resonating this principle, but also our response to it, is a comment from Dede et al. (2016) in relation to technology:

"When compared to context, goals, or pedagogical design, technology is arguably the least important component of a learning environment. That being said, the affordances of different technologies enable new variations and forms of organising activity. There are activities which are much easier to do with particular technologies when they are used well."

(Dede et al., 2016, p.36)

Therefore we think there is currently great value in reviewing modes and technologies of teacher education in relation to and while not losing sight of teacher education principles, not least because of the possibilities and potential for missteps of the rapidly developing potential for remote and blended teacher education being opened up by technological development and circumstance (including the present Covid-19 pandemic). Moreover, the reviews we have examined reveal a landscape which is ‘a divided, unsettled, and challenging space with pockets of acceptance, but characterised by epistemological and pedagogical questions, doubts, and uneasiness’ (Dyment and Downing, 2020, p.327, in relation to online/blended ITE).

While one modality may not be necessarily superior to others and the implementation is as important as the design, the affordances and limitations of the modes do seem to vary. We think that certain modes (such as mentoring and coaching enhanced with video lesson observations) stand out as being not just acceptable alternatives to face-to-face practice, but as having huge potential for both quality and practicality reasons. On the other hand, use of resources bases, certainly without the support of other modes, presents many more challenges for meeting teacher education principles (as well as unique potential benefits). Indeed, the fact that many programmes are combining modes and approaches is often in deliberate recognition of the strengths and weaknesses of each mode (Elliot, 2017). There is, therefore, value in attempting to grasp these.

We continue this discussion in connection with specific teacher education principles and perspectives from the literature. To ease this discussion the principles have been grouped with each other and related CPDL, leadership of CPDL and ITE principles connected where possible. While there is obviously no perfect grouping and delineation possible, these do bring together some connected considerations pertaining to teacher education modality for pre-service teachers, teachers and leaders for a more focused discussion.

Pupil orientation

| | |
|-----------------------|---|
| CPDL (and ITE) | <ul style="list-style-type: none"> • Pupil orientation – organising CPDL around colleagues’ aspirations for pupils including outcomes |
| Leadership | <ul style="list-style-type: none"> • Positioning CPDL as shared responsibility for pupil achievement and wellbeing |

Perhaps surprisingly, there is very little focus on pupil outcomes in the teacher education online/blended literature, much of which is focused on changes in teacher practices or thinking and/or teacher perceptions on and experiences of new ways of learning; this is especially true for the initial teacher education literature (Dyment and Downing, 2020). This can also be seen in our searches: when we screened 989 papers using full-

⁵ <https://educationendowmentfoundation.org.uk/news/celebrating-the-5th-birthday-of-the-teaching-and-learning-toolkit/#:~:text=The%20'Bananarama%20principle'%20states%20that,%2C%20that's%20what%20gets%20results%E2%80%9D.>



texts 749 (over 75%) were excluded from the review as they reported no empirical data on pupil outcomes from the teacher education of any kind. This flies in the face of the finding in the effective teacher education literature (e.g. see Cordingley et al., 2015) that the organisation of CPDL around teachers' aspirations for pupils and how teaching practices affect learners and learning was the only common feature of all effective CPDL. It is therefore a concern that such a large proportion of pieces describing and evaluating teacher education programmes paid such little attention to what, if any, benefits and impacts there were for pupils.

For an example of a programme where a pupil orientation *was* evident, we can return to the previously discussed 'Just-in-time' Advanced Placement Teacher Community (APTC) reported in Dede et al. (2016, Chapter 6). The programme platform was structured around a 'Prepare, Share, Compare' pattern, linked to the 'Active Physics' curriculum and its associated textbook and typical teaching structure. On the prepare portion of the platform (see p.162 for further details) teachers could access videos, lesson plans and were provided with information on the science content and common misconceptions etc.; Share was designed to allow teachers to share experiences, ask questions and receive responses from other members of the community in relation to content, pedagogy (and pedagogical content knowledge); on the Compare section, and pertinent here, is the space and expectation for teachers to use pupil data from quizzes to discuss their impact on pupils and inform their future instruction. The detailed discussion of this feature is particularly relevant to this section and is worth quoting at length:

"Similar to the Share forum, the Compare window has no postings originated by the creators of the site. It enables teachers to compare their students' quiz scores and overall progress to the scores and progress of other teachers' students and to discuss what might explain their differential outcomes...

... on a more detailed level, teachers can discuss the incorrect answer options that students found most appealing and use student data to inform their instruction...

... This just-in-time analysis of student results and memory of what transpired in classes is a unique feature of the Compare forum, which cannot be duplicated in traditional face-to-face professional development because of the time delay and the tendency to forget some of the details of the classroom environment. [This approach] is an adaptation of lesson study, a Japanese form of professional development in which teachers collaboratively plan and examine actual lessons. The consistent discussion, dissection, and sharing of lessons and classroom performance data on a regular basis is intended to hold some of the promise of the traditional lesson study approach, while opening it up to greater numbers of teacher via an online, real-time, just-in-time context."

(Levy, Eisenkraft and Fields, in Dede et al., 2016, p.174-5)

We are also reminded of the previously mentioned discussion of video observation in relation to cognitive science principles in (Jamil and Hamre, 2018). Below we repeat a quotation provided earlier, now with our emphasis on pupil orientation and how it can be achieved clearly in focus:



"Once teachers have made observations, we ask them to analyze the classroom interactions that have taken place by considering the ways in which their choices affect the children in the classroom. This step is important for helping teachers to see the specific consequences of their actions and use them as the criteria for determining effectiveness or ineffectiveness, instead of emotional reactions to situations (Preston, Campbell, Ginsburg, Sommer, & Moretti, 2005; Sherin & Van Es, 2007). If we return to the teacher reflection example that we started with above, we can see how after making her precise observations regarding the effective and ineffective interactions in her video clips, the teacher proceeds to make an honest appraisal of the consequences of these interactions for her students."

(Jamil and Hamre, 2018, p.229)

A pupil orientation goes beyond including some consideration of pupil outcomes (e.g. via for example analysis of pupil work or assessments during initial planning or following a lesson observation). Having a pupil orientation is to use aspirations for pupil experience and outcomes as a way of focusing and making coherent, all aspects of the teacher education activities, whether one is designing a curriculum, develop questioning technique or learning about effective assessment. 'How *will* children/young people benefit from, react to, and/or experience this?' and, 'How *have* children/young people benefited from, reacted to, and/or experienced this?' are the central, yet often neglected, questions at the heart of all teacher education activity.

We now turn to the general question of which teacher education modes are a good 'fit' for achieving this feature of teacher education? The general principle of 'distance to practice' here highlights that technology (and especially video) has the potential to bring classroom interactions into a teacher education space for examination, discussion and reflection, without the expense of face-to-face observations (i.e. around release time) and the reliance on memory – which will be most fresh immediately after the teaching and increasingly distant as time passes. We note that the Levy et al. (2016) example above relies on 'student *results* and *memory* of what transpired in classes' as the basis for discussion and practice development, whereas Jamil and Hamre discuss 'precise' and 'specific' interactions and their consequences⁶. Remote and blended modes provide – to a greater or lesser extent - a multimedia space to which it is possible to bring rich practice and pupil outcome stimuli for detailed discussion; some of these (e.g. planned seminars and platforms) tend to allow more structure (which allows pupil orientation to be 'built-in'); whereas for others (and especially informal online professional learning communities) it may be difficult to ensure a pupil orientation.

Overall, there are no modes within our framework for which it is *not* possible to include substantial consideration of pupil outcomes, and many which have advantages (such as cost and ability to create a larger community) when compared to face to face methods. Discussion of pupil outcomes is made easier when student assessments or artefacts (e.g. pupil work) as stimulus material and classroom video are built into the teacher education to make links between teaching and learning.

⁶ Here we are touching on points relating to the principle of focusing on theory and practice side-by-side and the importance of contextualisation and experimentation in the classroom (see below).



Collaboration and Support

| | |
|-------------------|--|
| CPDL | <ul style="list-style-type: none"> • Collaboration/peer support – ensuring this originates from iterative trialling and testing of new approaches and evidence about how pupils’ respond to accelerate trust, deepen ownership, and refine practice |
| Leadership | <ul style="list-style-type: none"> • Modelling openness to professional/leadership learning |
| ITE | <ul style="list-style-type: none"> • Manage risk and develop self-efficacy – helping pre-service teachers manage uncertainty and seek expert (including mentor) support, accessing the practical wisdom and reasoning of experienced teachers, and understanding how this relates to their own developing expertise (Twiselton, 2016), situating themselves in and contributing to supportive professional learning environments • Orientation to Professional Identity and Community – consider the implications of students typically being new to the world of work, professional working and school communities, supporting students to adopt a range of roles within a professional learning environment, begin the development of a holistic professional identity that fosters professional learning (of themselves and others), and advances and critically reflects on educational purposes and values of their communities and more widely |

A common characteristic of teacher education is collaboration. Being supportive of collaboration is one the elements of effective professional development identified in Darling-Hammond et al. (2017), who explain that:

“High-quality PD creates space for teachers to share ideas and collaborate in their learning, often in job-embedded contexts. By working collaboratively, teachers can create communities that positively change the culture and instruction of their entire grade level, department, school and/or district.”

(Darling-Hammond et al., 2017, p.v.)

With this principle and others, it is important not to take the simplistic interpretation that its mere presence will make for effective CPDL, or indeed that it is either a necessary or sufficient condition for effective CPDL. A pupil orientation (see previous) provides the most concrete example of another factor that may or may not be evident within collaborative activity. Collaboration, perhaps more than any other effective teacher education principle, is frequently out of line with the other principles. Collaboration can be a superficial ‘sharing of best practice’ or a rich exchange orientated towards how pupils are responding to teaching practices and curriculum, examining theory and practice side by side through iterative classroom ‘experiments’, and that is sensitive to participants’ level of experience (cf. the other teacher education principles). So it is not the presence of collaboration *per se* that matters; it is the who, what, where, why and how of it, and how it aligns to the other effective teacher education principles (and especially pupil orientation) which requires consideration.

Putting the detail of what constitutes effective teacher education aside, the focus here is on the ‘fit’ of particular principles with remote and blended modes of teacher education, and what new affordances, limitations and considerations come to light when putting teacher education principles and what we know about remote and blended teacher education modes side by side.



Presence, Participation and Interaction

A concept that appears often in the literature we have reviewed is that of ‘presence’, its importance and the potential difficulties of achieving it remotely. Elliott (2017) argues that PLCs (‘Communities of Inquiry’ in their terms) provide a model for effective practice across any online learning experience which includes ‘social presence’:

“Social presence can be described as interaction between course participants. Social presence is often identified as a key quality to be incorporated into online learning experiences since it is not something that always occurs naturally in an online environment (Richardson, Swan, Lowenthal, & Ice, 2016). A social presence can be beneficial for establishing a collaborative and interactive learning environment. This is achieved by helping students feel more involved and connected (Lowenthal & Dunlap, 2014). A social presence can be established in a course via synchronous and asynchronous means, including video conferencing and discussion threads (Lowenthal & Dunlap, 2014).”

(Elliott, 2017, p.118)

Eliot also discusses ‘cognitive presence’, and ‘teaching presence’ (p.118), which refer respectively to how learners interact with the content in the environment, and the instructional design and delivery within the course. Surette and Johnson’s 2015 meta-analysis suggests that it is *possible* to achieve all of these within an online space. Their analysis of 20 empirical studies (ranging from single-case qualitative studies to randomised controlled trials) indicated that ‘online PD that facilitated opportunities for collective participation enabled the teachers to (a) experience a high level of social connection with their peers, (b) engage in multiple opportunities to reflect on their teacher practice and the practice of their peers, (c) share knowledge and experiences with peers, and (d) increase their knowledge and understanding of unique instructional strategies’ (Surette and Johnson, 2015, p.266). Similarly, there are examples (e.g. Lin, 2008, in Keengwe and Kang, 2013, p.487) of students feeling a sense of ‘connection and active participation through online discussion’ even within a text-only format of an online discussion board. In some cases, interactions being online and/or asynchronous even has advantages for participation, including less confident students being ‘able to take the time to compose a response’ and participation being less tied to geography and timings of face-to-face interactions.

While high presence, in the above terms, appears to be possible, it also seems to need careful consideration when designing remote and blended teacher education. High participant attrition seems to be a general issue for online modes of delivery (e.g. see Goldenberg et al., 2018) as well as the issue of non- or highly-passive participation (Keengwe and Kang, 2013), with interactions being overly tutor-initiated and student responses limited in number or depth (Lantz-Andersson et al., 2018, p.309). These issues seem to be connected to both individual barriers to participation (which we examine further below) as well as characteristics of the online space in terms of its ‘presence’ and the ‘responsiveness’ of tutors or other participants. The inherent limitation of all non-face-to-face interaction, as Quinn et al. (2019, p.410) explain, is that ‘in online settings, the capacity to read body language and facial expression is limited, especially if communication is primarily through text, which challenges the intimacy and immediacy required for social presence (Tu and McIsaac 2002).’ This sense of connection with present, responsive others is not always achieved, as the teacher quotation in Owston et al. (2008) vividly captures:



"The one thing I found about [the online discussions] was that I get all these ideas and I do some writing and stuff and then press the button and it goes. Mentally it goes out there somewhere. I don't know does anyone see it? No response: does anyone care?"

(Owston et al., 2008, p.207)

While it is difficult from our evidence to draw direct connections between (lack of) 'presence' and the specific issues around attribution and participation, there is certainly plausible links to be examined here; many studies discuss the issue of presence as a design-consideration and measure of success.

Often linked to discussions of presence, participation and responsiveness is the question of instructor and facilitation roles for online courses. Many pieces discuss the roles and values of facilitators to support discussion and collaboration. Dede et al. (2016) devote a chapter (10) to the role and 'importance of moderators' within online STEM CPD, they describe their roles in online communities as being to: 'facilitate organisation, welcome newcomers, encourage contributions, support top contributors, foster commitment, address problems and model good behaviour' (p.274). Examples of moderator activity to foster discussion, collaboration and participation are also given within case studies within the overall volume, including the 'Just-in-Time' Advanced Placement Teacher Community (APTC) programme that we outlined as an example above (see Dede et al., 2016, Chapter 6). This particular case study notes the issues around critical mass for online communities, contrasting them to more directed online courses:

"Online communities necessarily have both producers (those who post content) and consumers (those who one read posts or lurk)... unlike an online course, where teachers and students may be required to post (and can be graded on the frequency, variety and complexity of their posts), the [Active Physics and Chemistry Communities] are voluntary online teacher professional development opportunities, similar to Wikipedia in that no one is required to post."

(Levy, Eisenkraft and Fields, Chapter 6, p.178 in Dede et al., 2016)

Expectations around participation, and preconceptions about these, seem to vary with teacher education modes as well as potentially being influenced by facilitators and formal or informal rules and etiquettes. Common rules relate to the expected frequency of contributing to fora and the need to respect the opinions and ideas of others⁷ (Keengwe and Kang, 2013). As with presence above, active participation is something often discussed and sometimes, but not always achieved in practice.

"Goodyear et al. (2001) described key roles of the instructor in an online course: content facilitator, technologist, designer, manager/administrator, adviser, assessor, and researcher. However, my review shows that many students are still in passive roles. Even though much research has talked about students' need to post, give feedback, and complete projects, their roles are still limited."

(Keengwe and Kang, 2013, p.488)

⁷ It is worth noting that a) it is not necessarily the case that social/professional culture and etiquette will automatically transfer to online spaces and b) that in many CPD programmes (e.g. see Perry et al., 2020) some discussion of the appropriate conduct and expected engagement in discussion and activity is felt to be valuable even in a face-to-face environment in order to manage risk and ensure inclusive and constructive conduct.



Getting the balance right between co-ordinated and/or mandated activity and spontaneous participation seems to be a common consideration in the literature. Lantz-Andersson et al. (2018, p.310) discuss how informally-developed online communities include a 'majority of participants that observed without making any visible contribution (so called lurkers).' And, at the other extreme, that the most active communities can often encroach on teachers' free time and leave many 'feeling 'overwhelmed' by the regular flow of information'. Whether or not this balance is well struck and/or whether communities are more formal or informal, Lantz-Andersson et al. found moderators had a key role:

"Clearly no online community is ever spontaneous and an entirely un-organized 'bottom up' affair. In the studies on formally-organized online teacher communities clear forms of leadership are seen as an implicit aspect of the institutional setup. However, even the most informally developed communities being studied were also found to depend on the sustained efforts of moderators... In this sense, the apparent difficulty of controlling and planning the activities of all members in large online-groups challenges the extent to which opportunities exist for fostering active participation (cf., Macia & Garcia, 2016)."

(Lantz-Andersson et al., 2018, p.311-2)

Community Formation

A theme within the teacher education principles relating to collaboration is the value of forming a professional learning community and working to orient teachers, and especially pre-service teachers, to participate within it. As touched on above, it is possible to wrap community elements around other (including more individualistic) teacher education approaches. Much attention is paid to culture and community development in the literature and reviews generally paint a positive picture of the potential to achieve this in online spaces. This can be seen in relation to online professional learning communities in Lantz-Andersson et al. (2018, p.310) where communities with a 'friendly, participatory culture' are supportive of experimentation, risk taking and searching discussion and feedback. This culture can take time to develop (as discussed in relation to video sharing and discussion in Perry et al., 2020). It is a relatively widespread view that community building and functioning benefits from a) there being an 'established history of sharing and working together' outside of the programme (Seddon et al., 2010, p.436) and b) there being face-to-face sessions which take place prior to or in between online activity (i.e. within a blended format) (Seddon et al., 2010; Owston et al., 2008; Matzat, 2013; Keengwe and Kang, 2013).

"Despite the relatively low participation in the online discussion groups, teachers in all three projects regarded the blended experience as very worthwhile. However, they felt that the face-to-face experience was the 'glue' that held them together as a community, and many thought that they would not have continued in a fully online environment were it not for the face-to-face sessions. "

(Owston et al., 2008, p.207)

It is also worth noting that online spaces are discussed both as a hindrance for community development (as above) and as a benefit: Seddon et al. (2012, p.435) relate Beatty and Allix's (2005) description of the potential of WebEx video conferencing technology as follows:



"They indicate WebEx's power to assist in maintaining the social, emotional and intellectual connectedness among all members of a large dispersed learning group; 'distant participants and on-campus student alike feel like they are all in the same space together'. They state that, with WebEx, 'being there—at a distance—is apparently quite achievable'. They describe how 'recapturing the missed 'learning' moment is possible' thanks to the recording/playback facility. They go on to describe online seminars as 'an educational teaching tool that assists learning, by transcending barriers of time and space'. The ability to provide the continuity of connection is thought to enhance the group and individual's confidence for learning with each other, asking for help and challenging when appropriate. This connection can more easily cross linguistic barriers allowing a person whose English (for example) is not strong, to craft a reply in an online discussion which they would not have the time or the linguistic resource to construct in a face to face debate (Ku and Lohr 2003). Others go further, suggesting that online environments can help students to transcend cultural barriers: for example, in an Islamic context, allowing women to interact in a more critical manner with ideas put forward by a man (Hassan 2003)."

(Beatty and Allix, 2005, as discussed in Seddon et al., 2012, p.435)

Overall, our reviews suggest that collaboration, including (emotional and pedagogical) support and belonging within professional learning communities is both possible and evident in remote and blended modes of teacher education, both formal or informal (but see Lantz-Andersson et al., 2018), and for both novice and established teachers (Lantz-Andersson et al., 2018; Surrette and Johnson, 2015).

Diagnosics, differentiation and teacher starting points

| | |
|-------------------|--|
| CPDL | <ul style="list-style-type: none"> • Diagnosics – identification and understanding of teachers' starting points (Professional identities practices and motivations, beliefs, approaches to learning, existing knowledge and skills and beliefs) • Differentiation – tailoring of learning experiences to teachers' starting points |
| Leadership | <ul style="list-style-type: none"> • Focussing on teachers' professional growth as well as developing knowledge/skills |
| ITE | <ul style="list-style-type: none"> • Managing Overload – balance the need for explicit, detailed instruction and the need to meet statutory expectations with avoidance of overload, helping pre-service teachers focus on the fundamentals of practice |

How can we 'differentiate' teacher education for teachers and their starting points? In relation to CPD more generally, we know for example that mentoring programmes are particularly effective for providing personalised, targeted support and instruction and this can improve retention rates for early-career teachers (Fletcher-Wood, 2020). To what extent are teacher diagnostics and differentiation possible within remote teacher education?

Modes that are built around the teacher education participants, such as mentoring or teacher-led discussion groups, lend themselves to diagnostics and differentiation in relation to teacher starting points. Similarly, where leaders and initial teacher educators can meaningfully guide and contribute to the teacher education, this allows the wider picture of a teacher's professional growth to be brought into focus and can manage overload, enabling teacher educators and leaders to focus in on fundamental points.

Here we return to issues from previous sub-sections around a) programme structure and its links to ownership and participation and b) the ability to use video and/or multimedia to bring classroom practice and pupil outcomes to light within the teacher education space. Trade-offs are apparent in relation to content, structure and assessment:

Content – the greater range of content available, the more tailored it can be to support individual teacher needs; but with more content comes a greater risk of overload and difficulties supporting participants to focus in on and discuss fundamentals. Perhaps the most extreme examples here are the large resource bases/repositories and informal, open networks such as twitter communities. While we may find that there is ‘something for everyone’, including particularly specialist and specific content to be found – many (and particularly pre-service teachers) may feel overloaded, and content may not be accompanied with instruction (to help the teacher navigate and identify the key pedagogical features of the resource) nor opportunity to discuss these with others. Moreover, and again returning to the example of the APTC, the Share and Compare sections of the online programme were deliberately not pre-populated by instructors. There are benefits in terms of both ownership and depth of thinking of creating and developing ideas, resources and communities – or contextualising more generic content for one’s own subject (Cordingley et al., 2018) as compared to being met with ‘off-the-shelf’ content for all needs and pre-existing communities into which teachers must orientate and establish themselves.

Structure – The other point touched on in previous sections is the use of structure to ‘build-in’ effective teacher education principles, including in this case opportunities for diagnostics (such as initial needs assessments, or implementation planning processes). Like with content, too much structure – particularly when used to maintain focus and mandate content (as opposed to design principles) – can reduce opportunities to tailor teacher education according to teachers’ aspirations and starting points. Examples include self-study courses with set content. Similarly, our experience of MOOCs is that many have set content structured into weeks or modules, and provided by instructors, which are then ‘softened’ by the presence of community building features such as discussion boards. The differentiation, if there is any, however, is mostly in the selection of units of study rather than how they proceed. As we discuss further below in relation to curriculum and expertise, there are of course advantages to greater levels of structure, especially for initial teacher education, where it is possible to curate, sequence and ensure coverage of a core curriculum.

Assessment – Looking at the literature, great claims are made about the potential for personalised learning via technology in teacher education and education more generally. A widely advocated variant of this idea is that a combination of learning analytics (from simple scores to analysis through artificial intelligence and machine learning) and ‘micro-credentials’ or units can make even the most structured and content-heavy programmes highly accessible and differentiated for individual needs. Dede et al., 2016, for example discuss the use of micro-credentials in the form of ‘digital badges’:

“A unique feature of digital badges is that they can easily be shared or aggregated, much like a professional portfolio, and the evidence behind the badge, since it is often also digital, can be examined to verify the value of the badge... Technologies such as badges and analytics can help teachers map their personalised learning pathways, identify their progress along them and point to appropriate resources to support needed next steps.”

(Dede et al. 2016, p.44-45)



Therefore, 'micro-credentials' represent opportunities to record newly developed practice, resources (e.g. curriculum plans) and achievements in a way that enables teachers and course leaders to return to and reflect on learning and authentic classroom artefacts (such as lesson plans, pupil assessments or work, resources developed), which capture and evidence the learning. There are several points within this general description: first, that micro-structures and credentials may allow more bespoke teacher education activity, perhaps at a cost of collaboration and guided support. Second, that multimedia technology can be used to connect and make accessible evidence relating to the learning to foster discussion and/or as a summative assessment. Third, micro-structures may indulge the concept of gamification. This is not something we discuss at any length here, but note that points, badges, levels and leader-boards are becoming ubiquitous features of many online spaces and are widely held to be beneficial features of learning design to encourage engagement and performance (Subhash and Cudney, 2018)⁸.

Discussion of assessment design in remote learning is a common feature within the literature for all forms of remote and blended teacher education. Burns (2011), for example, provides the following principles for assessment within distance education:

1. "Develop standards as determinants of success
2. Make formative assessment an explicit part of instruction (Heritage, 2010).
3. Measure instructional performance, not simply knowledge.
4. Measure teacher productivity. (But performance-based assessments alone are not enough, since they traditionally do not measure teachers' productivity, that is, how the combination of teachers' content knowledge and instructional practices impacts student learning)
5. Take advantage of technology for assessment.
6. Design a 'flexible assessment' system."

(Burns 2011, p.158)

Another consideration relating to assessment connects the above conversation about 'presence' to the question of feedback and honest, challenging and searching conversations about practice. Fear of criticism can be a barrier to participation in online communities (Khalid and Strange, 2016) and so diagnostic conversations or assessments of teacher practice often need to successfully navigate sensitive issues, despite – to varying degrees – some of the more human elements of interaction being pared back when interacting remotely or in an online space. As noted, this related back to questions of presence and developing professional learning cultures and communities, and the benefits and challenges of doing this in an online space.

A point raised in Qian et al. (2018) worth noting here – one to which we return in relation to our discussion of curriculum and expertise below – is that the starting points of teachers in relation to subject knowledge and experiences within a topic area can influence their engagement with PD:

⁸ Although we have our concerns about extrinsically motivated learning, and the individualisation of instruction outside of authentic school and professional learning communities.



"Our results showed that the teaching and computing background of teachers had a significant impact on the teachers' need for and use of online PD material. More specifically, novice CS teachers needed and used PD for developing their pedagogical content knowledge (PCK). Non-CS teachers needed and used PD materials emphasizing content knowledge. Experienced CS teachers believed they had little need for PD even though they were teaching a new course."

(Qian 2018, p.164)

This is an interesting point of contact between this section on differentiation for teachers, earlier discussions about the need for more experienced teachers to dial into and re-examine their extensive (and often tacit) expertise and experience, and the need for careful consideration of curriculum and employment of expertise, as discussed below.

One final point to note regarding teacher starting points not encountered within face-to-face teacher education is that teachers may be at different starting points with regards to their attitudes towards, experience of and skill with using technology and/or conducting teacher education remotely. This is borne out in the available evidence around teacher satisfaction with online teacher education:

"Research indicates that course management systems are effective for those familiar with technology, but that user satisfaction diminishes as user familiarity with the technology declines (Taylor, 2011; Tella, 2011; Thomas, 2010)."

(Elliot 2017, p.121)

Theory and practice, experimentation and contextualisation

| | |
|-------------|--|
| CPDL | <ul style="list-style-type: none"> • Theory and practice – emphasising practical theory alongside content and pedagogy • Contextualisation – ensuring content is contextualised for each subject but also for sub-groups of pupils – generic pedagogic CPD does not work on its own • Experimentation – effective CPDL involves carefully aligned sustained, iterative experimentation |
| ITE | <ul style="list-style-type: none"> • Grounded Instruction – providing well-illustrated, contextualised instruction and the opportunities and skills to closely observe practice and develop as reflective practitioners |

The next principle of effective teacher education relates to connecting theory with practice, and the reflection, and practical 'experimentation' that is needed to achieve this. As Darling-Hammond (2017) explains, effective teacher development:

"Incorporates active learning: Active learning engages teachers directly in designing and trying out teaching strategies, providing them an opportunity to engage in the same style of learning they are designing for their students. Such PD uses authentic artifacts, interactive activities, and other strategies to provide deeply embedded, highly contextualized professional learning. This approach moves away from traditional learning models and environments that are lecture based and have no direct connection to teachers' classrooms and students."



And

“Offers feedback and reflection: High-quality professional learning frequently provides built-in time for teachers to think about, receive input on, and make changes to their practice by facilitating reflection and soliciting feedback. Feedback and reflection both help teachers to thoughtfully move toward the expert visions of practice.”

(Darling-Hammond, 2017, p.v-vi)

Again, rather than the details of this, our concern is the extent to which this can take place through remote or blended teacher education approaches. While the focus has been more on reflections than iterative development of practice as part of or alongside teacher education, the literature was broadly positive. Lantz-Andersson’s et al. (2018) review of formal and informal professional learning groups identifies numerous examples of groups that fostered reflection on practice. In some cases, it was felt that writing (rather than saying) responses ‘was also seen to stimulate forms of reflection and self-analysis not evident in face-to-face meetings (Unwin, 2015).’ (p.308). Moreover,

“Communities were praised for confronting teachers with different views, opinions and suggestions (Romano, 2008; Unwin, 2015) and supporting them to look at their classrooms and situated experiences in different ways in what Dewert et al. (2003) term the ‘reflexive turn’.”

And

“For teachers working together in the same schools, increased visibility of colleagues’ beliefs, thoughts, problems and evolving practices online created entry points for subsequent face-to-face dialogue.”

(Lantz-Andersson et al., 2018, p.308)

Similarly, Surrette and Johnson (2015), examining online professional development environments, more generally find examples of online spaces being used for active reflection of new pedagogical practice that teachers were ‘instituting in their classrooms’ (p.262), and more generally conclude from their review that:

"Collectively, the results of these studies demonstrated that online PD enabled teachers to actively learn by (a) reflecting on their student’s work, (b) reflecting on their own classroom practices, (c) receiving feedback on their work from their peers, and (d) engaging with their peers in online discussion forums."

(Surrette and Johnson, 2015, p.264)

Picking up themes noted in our earlier sections, Surrette and Johnson (2015) found studies noting the benefits of being able to ‘rewind and review the video and record more complete and accurate comments than is possible during real-time observations’ (West et al., 2009, p. 384, quoted in Surrette and Johnson, 2015, p.263). Using video, there is also a greater opportunity to conduct the reflections and discussions collaboratively, drawing on a greater number of examples (Perry et al., 2020). Other authors such as Keengwe and Kang (2013) conclude that technological tools are important for integrating online and face-to-face learning and supporting learning to be put into practice, and also – as above – discuss the value of using technology to allow teachers to ‘actively participate, communicate, and create their own materials’ (p.488). Tools discussed in the studies used by Keengwe and Kang (2013) include multimedia CD-ROM, ‘blackboard’,



web-based models and sites, wikis, online discussion and lectures, interactive white boards and Ning, a community building platform. We are also reminded of discussions of tools for teachers in Timperley et al. (2007) and of ‘smart tools’ in Robinson et al. (2007).

A key idea here is that a) to combine theory and discussion, expert models of practice, and one’s own practice requires focus and experimentation over time (see points around duration, below) and b) sustaining this within teacher education benefits from artefacts, tools and technologies that bring practice and pupil learning (see pupil orientation section) together and across classroom and professional education spaces. This is as true for face-to-face as online/remote teacher education and, arguably, the latter has the affordance of a greater range of technology at one’s fingertips to be able to achieve this. Related, and discussed further in the section below about sustained activity, is that the asynchronous teacher education approaches and content allows professional learning to run alongside and shape to classroom activity over time. Returning to the point made in several previous sections, there is no guarantee that these exchanges lead to deep and critical reflection and discussion and – alongside the positive examples noted above – reviews provide numerous counter-examples:

“While these benefits were mostly intrapersonal in nature, studies did note a lack of critical discussion in the exchanges between teachers (e.g. Chen et al., 2009; Donnelly, 2010; Jarosewich et al., 2010; Prestridge, 2009). For example, participants were found to seldom challenge peers or engage in higher levels of analysis or reflection. When reviewing teachers' interactions in discussion forums, for example, the vast majority of responses to others' comments were found to be supportive without addressing the content of the course or furthering the discussion (Jarosewich et al., 2010)”

(Lantz-Andersson et al., 2018, p.308)

Curriculum and specialist expertise

| | |
|-------------|--|
| CPDL | <ul style="list-style-type: none"> • Specialist expertise – mobilising and integrating deep knowledge regarding CPD content, pupils, and community to provide expert support and challenge via: <ul style="list-style-type: none"> ○ Challenging of orthodoxies ○ Illustration of practices from other settings ○ Securing depth in learning via evaluation and design of CPDL activities |
| ITE | <ul style="list-style-type: none"> • Foundational Curriculum – provide an especially coherent and well-sequenced curriculum that covers all foundational knowledge while meeting individual needs of pre-service teachers, allowing pre-service teachers to acquire and refresh a significant body of subject content knowledge (ck), pedagogical knowledge (pk) and pedagogical content knowledge (pck) in tandem, exploring how these come together and their relation to pupil needs and learning |

Although there are important distinctions to be made between curriculum content and expertise (in terms of pedagogical knowledge, content knowledge and pedagogical content knowledge) in teaching the curriculum, we consider these collectively in this discussion of remote and blended teacher education in relation to a set of issues around how easy it is to incorporate expertise and create and sequence curriculum content within remote and blended teacher learning. In terms of the general teacher education principles, drawing on the points in the box above synthesising Cordingley et al. (2015, 2018, 2020) and additional accounts from Darling-Hammond (2017), effective CPD:



- **“Is content focused:** PD that focuses on teaching strategies associated with specific curriculum content supports teacher learning within teachers’ classroom contexts. This element includes an intentional focus on discipline-specific curriculum development and pedagogies in areas such as mathematics, science, or literacy.
- **Uses models of effective practice:** Curricular models and modeling of instruction provide teachers with a clear vision of what best practices look like. Teachers may view models that include lesson plans, unit plans, sample student work, observations of peer teachers, and video or written cases of teaching.
- **Provides coaching and expert support:** Coaching and expert support involve the sharing of expertise about content and evidence-based practices, focused directly on teachers’ individual needs.”

(Darling-Hammond, 2017, p.v-vi)

In relation to initial teacher education more specifically, greater attention is required to the foundational curriculum and whether this ‘covers’ the fundamental skills and knowledge for teaching within the chosen subject area and educational context, as well as meets statutory duties, thereby providing a strong basis for ongoing early-career development and beyond. There are therefore links here between teacher education curriculum content and teacher starting points, encompassing more general considerations about a more structured, comprehensive approach being needed for pre-service teachers as well as a more general consideration about varying curriculum content and drawing on expertise that meets the large range of teacher starting points. There is also a wider point about curriculum and the system to be made, especially in the context of England where, as reviewed in Cordingley et al. (2018, p.3), ‘teachers ... engage in less CPD overall and are less likely to engage in subject-specific CPD than in most other high performing countries.’ Moreover, there is a need to develop subject knowledge, which varies considerable by subject area and by phase (e.g. primary secondary phases):

“Of teachers in state-funded secondary schools, 49.6% of ICT teachers, 37.3% of physics teachers, 25.1% of chemistry teachers, 24.9% of history teachers and 18.6% of English teachers did not have a relevant post A-Level qualification (DfE, 2017).”

(Cordingley et al., p.19)

The report also notes how teacher education can take on different emphases in subject specific contexts:

“In maths, principles and theory were taught explicitly at the start to support depth of thinking and learning. In science, teachers learned through experimenting with new materials followed by activities to transfer those materials into classroom practice.”

(ibid. p.25)

Bringing this to our central question: to what extent is a subject-specific curriculum incorporating expert content and support possible in remote and blended modes of teacher education? Several responses to this question are apparent in the literature: first, authors note that online modes and technology can be used to bring together larger groups, which are more likely to incorporate and/or find it more economical to draw on specialist expertise (including top scientists, public figures and outstanding educational leaders and practitioners etc.), as well as develop subject-specific content. With larger-group modes such as MOOCs this



is further accentuated, although Dede et al. (2016) note that for MOOCs, splitting up by subject specialism sometimes reduces opportunities for cross-pollination of ideas and connection, which can come by splitting large groups by roles, interests and geography (e.g. when trying to establish a blended community in a local area). At the extreme, as they suggest, it is possible and, in many ways, beneficial to make group splits even more arbitrary, splitting by the first letter of the participant’s city for example.

Overall, there seems to be a strong case that online teacher education, particularly when built around platforms and/or resource bases, and a strong curriculum content offer with specialist input is eminently possible, and indeed has many advantages over exclusively face-to-face approaches (including the ability of teachers to locate specific (e.g. ‘just-in-time’) content, fitted to their needs, and work through and engage with it individually or collectively in their own time. This connects to the above discussion around content and structure for differentiation, also to connecting theory and practice in their classroom. This is a familiar theme, which is echoed, as elsewhere, when our reviews come to consider curriculum content in online or blended teacher education, with both positive and negative examples discussed, such as the following excerpts from Surrette and Johnson (2015) about some of the possible issues:

“Analysis of the collected data revealed that the participants harbored negative attitudes toward the content of the online PD. Unlike the aforementioned studies, the teachers indicated that the content was disconnected with their classroom practices, repetitive, and boring... An extensive search of existing scholarly literature revealed a lack of empirical studies that examined the ability of online teacher PD objectives to correspond with school, district-level, and state educational goals... Teachers often disengage and learn less from PD programs once it becomes apparent that the objectives of the PD are not aligned with district and state standards and assessments (Garet, Porter, Desimone, Birman, & Yoon, 2001).”

(Surrette and Johnson, 2015, p.262, p.264, p.266)

Other issues raised in relation to curriculum are familiar from the previous section. Lantz-Andersson et al. (2018) draw a parallel between superficiality in informal professional learning communities with respect to engagement in discussion with superficiality in more formal communities in relation to engagement with course content (p.311).

Duration and organisation

| | |
|------------|--|
| CPDL | <ul style="list-style-type: none"> • Duration – iterative experimentation needs to be sustained over time to allow for gradual assimilation, testing and refinement. Short term CPDL can work for very tightly specified approaches to particular aspects of teaching for very specific stages in learning (e.g. spelling of a subgroup of words). Time is required to incorporate results into practice |
| Leadership | <ul style="list-style-type: none"> • Designing structures/systems for managing complexity taking fully into account the cognitive, practical & emotional demands made by CPDL approaches and systems |
| ITE | <ul style="list-style-type: none"> • Organisation of the curriculum to ensure content and aims are sequenced and prioritised to fit the training timescales, structure, statutory and non-statutory requirements of teacher preparation, and particular learning and practice settings |



The final teacher education principle addressed in this section is the value of approaches that are sustained over time and thereby create the opportunity for earlier principles around meaningful connections with classroom practice and the need to gradually incorporate new thinking and practices into teaching repertoires. We hasten to add, however, that there are examples of more short-term teacher education programmes, which when well-targeted and tightly specified can have significant and lasting impact (see Lauer et al., 2014, for a review focused on this specific question). Be that as it may, effective teacher education typically is sustained over time and establishes a rhythm of activities that give teachers time to practice, reflect on and embed techniques in their classrooms (Cordingley et al., 2015; Darling-Hammond, 2017).

We note that the additional flexibility around timings (including remote and asynchronous participation) afforded in remote and blended learning approaches, combined with the use of technology and pedagogical/reflection ‘smart’ tools (see earlier) is a supportive factor for practicably sustaining teacher education over time. In this section, now this has been noted, we move on to discuss the question of flexibility versus structure for remote and blended teacher education design. Often the structure for professional learning is provided by a school curriculum, such as the AP Physics programme discussed above, or (and especially in the context of initial teacher education) a set of teacher standards (Elliott, 2017). There is an extended discussion of flexible design for remote initial teacher education in Burns (2011), who argue that:

“One of the most common misconceptions in distance education is that face-to-face curricula can be transferred wholesale to a distance education format. Although this has unfortunately often been the approach, distance education courses must instead be designed flexibly (Williams, 1999; Hope, 2006) and specifically for the medium through which they will be delivered—be it radio, television, immersive environments, multimedia, or online courses... ‘Flexible design,’ like the rubric under which it falls, instructional design, is a broad term that advocates providing learning resources and technologies to all learners in order to create, store, and distribute content (Hope, 2006). It proposes that content be organized in multiple formats, used in a variety of activities, and accessible through a variety of technologies to allow for customized learning experiences... Flexibly designed courses favour ‘ill-structured’ activities over well-structured ones, interactivity over passivity, inductive over deductive instruction, and activity over text and lecture. Such course design supports both individual and group learning and promotes applied approaches to learning (Austin & Brown, 1999).”

(Burns, 2011, p.138-9)

Burns also discussed how this approach is accompanied with ‘flexible delivery’, where instructors look to tailor the programme to learner needs (see discussion of differentiation, above). As she discusses, online teacher education can be organised so that it provides, and promotes engagement and accessibility through:



- “Realistic options and choices in terms of time, place, and technology
- Multiple modes of delivery—in the workplace, in block modes, modules, interactive formats, and other nonstandard modes of delivery
- Alternative options—including on-campus, in-class, independent lectures, seminars, tutorials, and practical sessions
- Accommodation of learners’ diverse learning needs and styles
- Use of technology and resources to provide options to any students to access and use materials in their own place (e.g., Web-based teaching materials and exercises or assessments that are not time- and location-specific)”

(Burns, 2011, p.138-9)

Similarly, flexibility is frequently linked with convenience and the ability to tailor learning to meet individual teacher needs. For programmes tightly structured around particular curricula, along with the benefits discussed above in terms of ‘just-in-time’ learning came practical problems of timing. As discussed in Owston et al. (2008), teachers were often not teaching the same topics at the same time and a degree of alteration to teachers’ plans was needed to fit in and align activity. As a general rule, flexibility around timings and online approaches helps teachers fit learning around their professional commitments and school timetables, avoid the need to use weekend days for group activity and better fit with personal circumstances. The only negative point in this area we found in reviews was the concern in Lantz-Andersson et al. (2018, p.312) that ‘flexibility also introduced a risk of ‘never-ending’ engagement, and online professional learning encroaching into teachers’ non-work time and becoming an additional source of over-work’.



Review of Empirical Evidence

- Q3.** *What empirical evidence is available that supports, refutes and/or refines our understanding of effective remote or blended teacher education (as per Question 2)?*
- A. Which forms or practices are identified as more/less effective?*
- B. What are the common features of effective approaches?*
-

This section reports results from 24 empirical studies that met our inclusion criteria. The first 19 present empirical results (including evidence of impact or otherwise on pupils) of remote and/or blended teacher education programmes. The final 5 include consideration of more than one mode (remote, blended and/or face to face) and thereby enable a form of comparison between modes. We summarise these 24 pieces individually within three broad groups, and we do so listwise (i.e. one by one, in their entirety rather than reporting selectively and/or according to themes).

We also summarise results in relevant sections from one recent systematic review (Snell et al., 2019), which presents a systematic review of ‘technology-mediated language and literacy PD models’ for teachers of early years (reception/kindergarten and pre-school) children. This review focused on random or quasi-randomised experimental studies, finding 11 in total.

During planning of the review, we expected the literature to be patchy, mostly incoherent, and varied. This is one of the key reasons for the more exploratory, theoretical questions above, which present a larger canvas to which we can partially match the selective evidence revealed in this section, examining areas of agreement and disagreement in the final discussion section.

The Efficacy of Remote and blended Teacher Education

There are a group of studies that have evaluated remote or blended teacher education programmes, measuring impacts on teachers and students. They are reviewed in this section. These do not seek to compare modality; indeed, many do not foreground the modality: the fact that some or all of the teacher education programme is remote or blended is – for some – incidental and raised only in specific results or discussion points. The studies reviewed below, provide us with some of examples of remote or blended programmes that have been evaluated, and evidence of varying quality about whether they work or not.

Coaching and Mentoring Interventions

The evidence base for blended or remote coaching/mentoring of teachers was limited; however, there were a few high-quality, highly relevant studies. Allen et al. (2015) present a study based on a stratified randomized controlled trial of the *My Teaching Partner–Secondary (MTP-S)* programme, a web-mediated coaching programme involving 86 secondary school teachers and 1,194 secondary students. The programme was conducted over 2 years involving 12 coaching cycles, where coaches selected extracts from the teachers’ own lessons that they had videoed for the teachers to reflect on their pedagogical practices before discussing by



telephone (Allen et al. 2015). Students' scores on the Virginia state standardized tests rose significantly (Effect Size⁹ = 0.48) compared to controls.

In contrast, Kraft and Hill (2020) reported on a web-based coaching programme designed to improve teaching of mathematics in relation to a *Mathematic Quality of Instruction (MQI)* framework using a 'MQI Coaching' model involving 'Cycles' of coaching using the MQI framework. The MQI is a well-validated instrument which provides a theory of action for the programme and a measure of specific aspects of teaching to target. In overview:

"The MQI offers items that capture 16 key practices for mathematics instruction, including precision in the use of mathematical language, connections between representations and solutions, and student mathematical communication, reasoning, and explanations...

In MQI Coaching, the instrument structures teachers' and coaches' reflections on, and conversations about, short videos of math instruction. A central element of our theory of action was that if teachers could learn to analyze instruction using the MQI's items and practice descriptors, they would (a) use more of the practices contained in those items and (b) strengthen the quality of these practices as implemented in their classrooms."

(Kraft and Hill, 2020. P.5)

The programme involved 142 elementary and middle school teachers from 51 schools, supported by 24 expert MQI coaches (all with experience with the MQI, as classroom teachers and/or instructional coaches). Their randomized field trial indeed showed improved teaching using the MQI instrument and a higher likelihood of teacher retention for teaching maths, and in particular teaching maths in a grade (year group) with a high-stakes maths examination. Student gains (as effect sizes) however were estimated to be minimal, with estimated effects of 0.00 (2dp) on state tests, and 0.07 on a Measures of Academic Progress (MAP) test¹⁰, neither of which were statistically significant. There were not clear reasons why student gains were not achieved/evidenced: the authors suggest issues of low statistical power (there were large confidence intervals on the estimates), issues with standardised tests capturing all student learning and/or lack of programme efficacy.

Snell et al. (2019), the systematic review included in this section, reviewed evidence for various professional development programmes in language and literacy for teachers in early years settings. There were several areas of reporting:

- **'Remote, non-live, asynchronous coaching'** – this included further studies of the My Teaching Partner (MTP) programme (as per Allen et al., 2015, above). Results were mixed, with Pianta et al. (2017) and Mashburn et al. (2010) finding mixed results on student learning outcomes, and Early et al. (2017) not finding an impact on language or literacy outcomes.
- **'Remote live coaching'** programmes, finding only one effective trial: Vernon-Feagans et al. (2015, 2013) used remote live coaching with webcams and found effect sizes around 0.5 for four measures

⁹ Calculated using Hedge's *g*

¹⁰ A computer-based adaptive test assessing math skills for students in Grades 2 to 12 provided by the Northwest Evaluation Association.



of reading ability for early years. Note that these studies also included other interventions, such as online materials and even a 3-day workshop for this last study.

- **'Enhancing' Tech PD with in-person coaching'**, where Landry et al. (2009) found that in-person coaching i.e. a blended approach improved pre-school children's reading skills with effect sizes around 0.2 (CIRCLE study). But Jackson et al. (2006) found mixed effects.

Our final study in this section is Rosenberg et al. (2020), who reported on individual coaching for paraprofessionals (teaching assistants) about self-advocacy for students with disabilities. An initial 45-minute individual teaching session was followed by distance bug-in-ear (BIE) coaching via the Zoom platform. They report improved student behaviour but there were just four adult-student pairs and no controls. Nonetheless, it is interesting to note the study's use of advancing technology in the form of video conferencing and 'bug-in-ear' coaching tools.

Mixed Component Interventions

Having looked at mentoring and coaching interventions separately, we now turn our attention to other programmes, noting the variety of approaches in use. The following studies are mostly reporting programmes that combine instructional content and sessions, which deliver this with wrap-around teacher discussion and/or implementation tasks to promote application to classrooms.

Ascetta, Harn & Durán (2019) reported on a brief (4–6 weeks, ≤ 1 h per week) online programme that focused on: (a) teachers' self-monitoring and goal setting; and (b) language enhancement strategies to use in practice. They were interested in the impact of the type of feedback strategies used with the teachers, who were then randomly assigned to the type of feedback they received across the intervention: performance or self-report. Regardless of feedback condition, all participating teachers increased their frequency of language enhancement strategy use, and all children had enhanced vocabulary skills performance. They concluded that further research should be undertaken with larger groups and child outcome measures with better sensitivity and validity. We suggest that a comparison to other or no PD would also be useful.

Dash et al. (2020) examined the impact of participation in online PD on 5th grade mathematics teaching. The PD consisted of 1 course per semester over three semesters, including 1 week of orientation and 6 weeks of content per course and equating to approximately 70 hours work per teacher. The delivery was asynchronous, with trained facilitators to monitor the completion of activities. It utilized a learning community model including readings, web-based resources, interactive on and offline activities, video, and peer-to-peer discussions. Teachers were required to implement a final project in their classrooms. Participants in the PD scored significantly higher overall for pedagogical content knowledge than teachers in the control group and had greater gains in scores for overall pedagogical practices. However, no significant differences in changes in students' maths achievement were identified.

Our next study is Fishman et al., (2014b) who report results from a survey of 6,796 (Advanced Placement Curriculum) Biology teachers, which are matched to subsequent student scores. Teachers were provided with 'a range of professional development (PD) options, from week-long summer workshops to short face-to-face (FtF) courses, online self-paced courses, downloadable resources, and online peer-learning communities' and 'two high-quality PD offerings from outside providers included in this study.' (p.3) There are limitations in methodology, including the inevitable self-selection in the extent to which teachers engage with the



professional development and also complete the survey. Overall, they find (p.15) that ‘some of the patterns of PD selected by teachers were predictive of student outcomes on the AP Biology exam, although effect sizes were small’. They sum up as follows:

“Overall, it appears that student achievement is more likely to be related to a spectrum of variables associated with teachers and their PD choices, rather than any individual factor or choice.”

(Fishman et al., 2014b. p.15)

Frumin et al. (2018) undertook a 5-year longitudinal study of the participation of US high school science teachers in an online teacher community supporting curriculum change. The study focused on teachers’ patterns of usage, the impact of usage on the performance of their students, and how the PLC might harmonise with established programmes of PD. A clear association was found between teachers’ participation and higher student examination scores, though causality could not be assumed. Interestingly, the frequency and duration of participation did not have a clear association with test scores. This project built on the earlier study by Fishman et al. (2014b), as immediately above.

Goldenberg et al. (2014) note the challenge of convening and supporting role-alike groups of teachers to provide specific training. They implemented a randomized control trial that focused on PD for Biology teachers to improve content knowledge, pedagogical knowledge and use of digital media in teaching. *Teaching High School Biology* was a fully online programme that included 4 sessions on teaching genetics and evolution using digital resources and inquiry-based approaches, utilizing readings, video clips, notebook work, discussion boards, and assignments. The study found significant teacher knowledge increases despite high (50%) teacher attrition rates, albeit no effect on student outcomes – perhaps because of difficulties measuring pupil outcomes from inquiry-based learning.

Griffin et al. (2018) studied 32 elementary maths teachers for children with disabilities in the US participating in a PD programme called Prime Online. This consisted of 35 Moodle modules over 12 months with clear taught content, plus online discussions etc. with a focus on teacher beliefs (about maths teaching, students with disabilities and teacher inquiry) and teachers’ mathematical knowledge. Positive teacher impacts were found, but there was no impact on the students. There were no control conditions, and it is not clear which aspects of the programme were beneficial.

Steve Shaha has been involved in several related studies in this section. Shaha and Ellsworth (2013) compared comparative gains (from one year to the next) in mathematics and reading standardized assessments for school with teachers with high levels of engagement with *PD 360*, which ‘offers a large library of expert-produced training videos, powerful support tools and resources, and an online professional learning community of nearly one million educators’ (p.176). 169 schools were selected and compared with average gains for their Districts. Students in these schools experienced 18.9% increases in mathematics scores versus 4.2% for their districts, and 15.3% increases in reading versus 2.5% for their districts. Shaha, Glassett and Copas (2015b) showed that these gains were further extended with an additional follow-up year. Similarly, Shaha, Glassett, Ellsworth (2015d) suggest the greater the number of years of high participation in the programme, the bigger the effect. A similar approach and results are shown in Shaha et al. (2015a). Shaha et al. (2015c) focuses on Title 1 schools (low income/ disadvantaged), whilst Shaha et al. (2016) considered schools with high engagement in PDL Seminar as well as *PD 360* in Title 1 schools. With all of these studies, without



randomisation to receive the programme, these gains may reflect teacher self-selection into their degree of engagement with the programmes and/or general school characteristics rather than *PD 360 per se*.

Walker et al. (2012) looked at 2 designs for online PD to help teachers learn to create online activities for students. One focused solely on technology skills to design student activities using online resources, while the other coupled technology skills with learning to design PBL activities for their students using online resources. The quasi-experimental study involved 36 mathematics and science junior high school teachers (51 initially signed up) and 1,247 students over a sustained period of 3 months. Both designs showed significant gains in 'self-reported knowledge, skills, and technology integration' for teachers. There were also 'self-reported gains in behaviour, knowledge, and attitudes' for all students, though those taught by PBL teachers scored greater gains on behaviour and knowledge. PBL teachers had larger gains in PBL knowledge and use than the tech-only teachers. Limitations included the fact that teachers selected the class to administer the student survey; students may have provided socially desirable responses and there was potential for pre-existing differences between treatment groups, such as prior exposure to PBL.

The final study reported in this sub-section is Weschke, Barclay & Vandersall (2011), who undertook a small-scale study of 31 elementary teachers who completed a fully online master's programme focused on pedagogy and literacy matched with a comparative sample of 39 teachers with an existing masters level qualification who did not complete the online programme. The study looked at the impacts on oral reading fluency of students as a measure of efficacy by undertaking 3,828 student observations. It was an attempt to establish the impact on the education community of a high demand and fully online programme. Hierarchical linear modelling was used to understand the longitudinal effects of teachers on student learning. The findings indicated a significant positive effect of the online programme on student achievement. The results indicate that a fully online programme for teacher training may offer opportunities for teachers to improve instructional effectiveness by obtaining pedagogical content knowledge. The authors therefore suggest that LEAs should consider recruiting graduates from similar programmes. However, the results were not constant across different elementary grades. The study suggests more research needs to be conducted on why student outcomes resulting from online PD vary according to age and stage.

Interventions for Student Behaviour

There were two studies that focused on student behaviour that met our eligibility criteria. First, Marquez et al., (2016) report initial results from several studies of a programme designed to improve student behaviour via videos, an interactive online planning tool, downloadable strategy sheets. Comparison of pre and post tests showed improvements in teacher knowledge and high satisfaction, but any benefits for student behaviour were not apparent until follow-up and differences between the treatment and control group were not statistically significant.

Second, was Hoffman et al. (2020). This study reports a randomised controlled trial of an intervention for teachers of pre-school children called Wellness Enhancing Physical Activity in Young Children (WE PLAY). WE PLAY was designed to increase children's activity levels. There were 25 teachers and 57 children involved in the trial. The study found that students whose teachers received the intervention engaged in 63 minutes of additional moderate-to-vigorous physical activity per week.



Comparing the Effectiveness of Teacher Education Modes

In this section we review five studies, a meta-analysis (Hill et al., 2020) and a systematic review (Snell et al., 2019), all of which present results that allow comparison of the effectiveness of teacher education modes or combinations of them.

An early study in this area is Fisher et al. (2010,) who compare a virtual workshop with an actual workshop, both focused on developing a Concept Mastery Routine (CMR). The study recruited 59 certified teachers and randomly allocated them to one of the two groups. The virtual workshop (VW) made use of a school's computer 'lab' and a multimedia software programme.

“The VW for the CMR was a multimedia software program (Fisher & Schumaker, 2008) created using Macromedia Authorware. For this study, the software was distributed to participants on two compact discs. Through the coordinated use of text, video, audio, and animated graphics, Disc 1 explicitly instructed users about the routine's purpose, instructional sequence, and the Concept Diagram. Moreover, it prompted users through the process of preparing an initial draft of a Concept Diagram. Disc 2 was a classroom simulator. Through the coordinated use of multimedia, it guided teachers in the application of the routine. Specifically, it allowed the user to access a lesson plan, interact with virtual students, receive support from a virtual coach, and record information on a virtual Concept Diagram.”

(Fisher et al., 2010, p.304)

The face to face session (the 'actual workshop' – AW) the classroom was set up with 25 to 30 seats in rows. To ensure comparability in other respects, both VW and AW had an instructor's computer, data projector, a screen and whiteboards; the AW translated this material into powerpoints and other documents, and made use of the video clips from the multi-media CD in the session. Comparisons of pre and post test data show that there is no difference in student tests of concept knowledge between the students of teachers who participated in the face to face or virtual PD, although teachers expressed slightly more satisfaction from face-to-face PD.

Another early study, one that received considerable attention in the literature (see discussion section) is Fishman et al. (2013). This was a randomised experiment involving a total of 49 teachers that explicitly set out to compare online and face to face professional development. The PD aims to prepare high school teachers to implement a year-long environmental science curriculum, increasing the probability that curriculum enactment is consistent with original design and outcomes. Teachers either received a week-long (48hr) course spread over 6 days, consisting of face-to-face workshop sessions or an online alternative 'to be completed by teachers asynchronously at their own pace', consisting of a series of 'short courses with a facilitator guiding teachers and answering questions as they worked through the materials' (p.429-430). The online materials also included a discussion forum, although its use was neither encouraged nor discouraged. The online group did receive some face to face contact:



“To alleviate concerns that teachers might not be successful with the online tools, we convened teachers in the online condition for a 2-day (16 hr) face-to-face orientation session. During this session, teachers were introduced to the online environment and received a general orientation to the curriculum identical to the orientation that the teachers in the face-to-face condition received. Because of this initial face-to-face session, our online condition might be considered ‘blended’ or ‘hybrid’ PD in a strictly technical sense.”

(Fishman et al., 2013, p.430)

The authors note that the curriculum content on which the data-gathering and analysis focused was not presented in this orientation session and, therefore, they consider the programme to be best described as ‘online’. The study was designed to ensure that the two conditions provided the same content, including the same computer-based simulations and print-based materials. There were, however, differences in interactions, in line with the affordances of the two modes:

“Where facilitators in the face-to-face condition used PowerPoint to present material, teachers in the online condition would read the same material as text ...

Teachers working shoulder-to-shoulder for a week tend to develop local community, and questions and discussions related to the core content may emerge that go beyond the original agenda... The online PD was designed to be an individualized experience, where teachers interacted primarily with the materials and with facilitators...

While we designed the online PD content to match the face-to-face content, and while our intent was that the online PD should take about the same number of hours as the face-to-face PD, in practice, there is no way to control how quickly or slowly an individual teacher moves through the online materials. We view this as a positive design affordance of online PD, and one that teachers might find appealing. Teachers in the online condition were not limited in terms of when they could interact with the materials, and were free to engage with PD much closer to the time when they enacted related lessons, so that it was fresher for them than it might be for teachers in the face-to-face condition. They may also elect to review materials or spend more time on particular sections of the PD.”

(Fishman et al., 2013, p.430)

Coming to the results, Fishman et al. (2013) find increases in subject knowledge for both online and face-to-face groups, with little difference in the gains between the two (controlling for pre-test scores) and no differences between the conditions in relation to a range of teacher attitudinal measures. In relation to student outcomes on an environmental science scale, the students of teachers in the online condition improved by just over half a standard deviation, the students in the face to face condition, one smaller than half a standard deviation, but the difference between these was not statistically significant. One especially notable finding within the study was the lack of a relationship between ‘contact hours’ and student performance in the online condition.



“Because we found no relationship between amount of time teachers spent on online PD and our outcome measure, we conclude that teachers who completed online PD more rapidly required less time to benefit from materials. Online PD does not have to be ‘one size fits all’ in terms of participation.”

(Fishman et al., 2013, p.435)

The next study we examine is Rock (2017). This doctoral thesis presents results retrospectively comparing student assessment scores for students of teachers who participated in online or face to face state-grant-funded professional development. The study looks at whether the mode of PD delivery was associated with student outcomes of pupils taught by the sample of 216 elementary teachers and 216 high school teachers. In overview, 105 of these teachers engaged in F2F PD and 327 took part in online sessions. The results found no statistically significant difference between the two modes of PD in terms of student impact, concluding that, ‘when the content of professional development is comparable, the form of professional development and the level of instruction have minimal effect on student learning outcomes.’ (p.186)

Webb, Nickerson and Bush (2017) present a comparative analysis of student survey responses (n=4,832) between teachers (n=75, K-12) who undertook different modes of professional development in the context of a computer science (game design) curriculum. The survey items related to student’s dispositions towards the curriculum, their aspirations relating to the subject and enjoyment and engagement in class. There were very little differences across the survey items when comparing students of teachers who received professional development in different modes. The authors do make a helpful distinction between Massive, Open, Online Courses (MOOCs) and managed online PD with smaller groups. They state that their completion rate (60%) is higher than that found in typical MOOCs and accredit this to the ability to develop a sense of community and provide facilitator support in smaller groups.

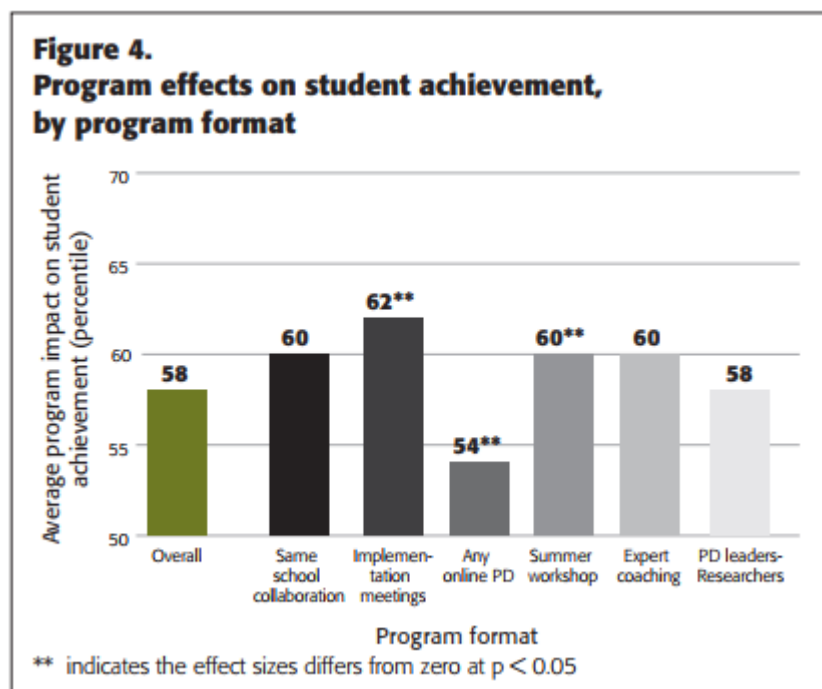
The final individual study reported in this section is Russell et al. (2019). The study compared the effects of a professional development course for teachers of maths in grades one to five in an online and a face-to-face format. Participants were randomly assigned to one of the conditions, both delivered over the same eight-week period.

“In the version we term ‘online’, participants logged on to the course website to access course materials. The course website’s discussion board provided the platform for participants to communicate with other course participants and the course facilitator. The online course followed a weekly schedule and participants were expected to spend three hours each week interacting online with their peers and completing course activities. Each online cohort had two course facilitators: one content expert and one online facilitation expert... In the second version, which we term ‘face-to-face’, participants attended weekly class sessions throughout the 8-week duration of the course. Each class lasted for approximately three hours. The face-to-face cohort had one course facilitator trained and experienced in DMI... The course facilitator followed a syllabus that was identical to that used for the online version... Participants spent much of the class sessions working in small groups with other teacher participants. Some teachers independently exchanged email addresses with one another and communicated outside of class.”

(Russell et al., 2019, p.74-75)

Using a range of data sources, the authors find that, ‘both formats of the course showed significant impacts on teachers’ mathematical understanding, pedagogical beliefs, and instructional practices’ (p.71). Student outcome data were minimal, although enough to meet our eligibility criteria, and were only collected through a student survey. This student survey asked about instructional practices of the teachers and their quality; no statistically significant differences were found between online and face-to-face groups.

Finally, we review results from Hill et al.’s (2020) meta-analysis of STEM PD and Snell et al. (2019). We only provide a single result from Hill et al. (2020) as the report is focused on CPD in general – but this result is a significant one. They present meta-analysis of the effect of STEM professional learning programmes according to various PD characteristics relating to its development, type, focus and – pertinent for our review – format. Regarding the latter, standardised effects from a total of 95 studies of professional development (including six which provided curriculum materials) were summarised in terms of the average percentile rank for intervention students compared to control/comparison students in the 50th percentile. In their Figure 4, which we reproduce below, the present results by programme format:



(Hill et al., 2020, Figure 4, p.54)

These results from the 95 studies within the meta-analysis suggest that ‘Any Online PD’ (i.e. not entirely face-to-face) tends to have positive, but lower effects than other formats, with about half the overall increase. Whether this is reflective of the quality of the online programmes or is something related to the mode *per se* is difficult to determine from this brief and ‘high-level’ view meta-analysis. A fair comparison between modes would deliver the same content through more than one mode, rather than programmes that ‘naturally’ do or do not include an online element (which may be of a different nature or quality for reasons other than the mode). The more general results about effectiveness echo the effective CPD principles that we outline in our literature review section, and results relating to STEM-specific reported from (Cordingley et al., 2018):



“In other words, the more effective programs combine curriculum and professional development (as we saw in Figure 2) and also provide targeted support for teachers to improve their content knowledge and knowledge of student learning. A reading of these studies suggested that such programs engaged teachers in solving mathematics problems, taking part in scientific investigation, watching facilitators model instruction, and studying student work.”

(Hill et al., 2020, p.54)

Finally, we examine the systematic review reported in Snell et al. (2019). This reviewed evidence for various professional development programmes in language and literacy for teachers in early years settings. They report studies from across our remote and blended approaches (Q1, above). Here we mention only results that compare CPD modes or difference remote and blended approaches. In relation to remote and blended coaching, Snell et al. (2019) identify the Classroom Links to Early Learning (CLEL) programme (Powell et al., 2010), which used asynchronous coaching with teachers sending videos to their coach. There were 7 remote sessions spread over one semester; crucially, similar effect sizes were found as for live, in-person coaching for early literacy development. Snell et al. (2019) found that all PD programmes they reviewed provided course materials online, which teachers could access and study on their own. While most studies did not separate the effect of this from other components, two examples are reported. As Snell et al. (2019) report:

“Specifically, MTP (Pianta et al.) included one intervention group in which teachers were given access to the online course and one intervention group that received the online course and remote asynchronous coaching; researchers found that teachers in the online course group did not improve in teaching quality (nor did their students improve in outcomes), whereas the teachers who also received remote asynchronous coaching did. This suggests just having access to the online course was not enough to improve teaching quality or child outcomes. However, contrasting findings emerged from RIA. The RIA study consisted of one condition receiving a downloadable curriculum and a second receiving an online course and the curriculum. Here, access to the online course and curricular materials was no better than access to curricular materials alone.”

(Snell et al., 2019, p.214)

Findings relating to online group courses were mixed. Of the two studies reviewed, one reported student outcomes (Jackson et al., 2006), finding positive results on two measures, but no significant difference on two others. Snell et al. (2019) conclude their review as follows:

"These results also showed that Tech PD programs can be as effective as in-person PD programs, with effect sizes in the moderate to large range for impacts on teaching practices (i.e., Cohen's $d > .5$) and in the small to moderate range for impacts on student learning (i.e., Cohen's $d = .2-.5$). These studies may also suggest that the PD content was well developed and tested and that the technology was successfully used as method of dissemination... In most of the Tech PD studies, not all measured outcomes showed positive results. Sometimes the effects were similar between in-person PD and Tech PD, and sometimes this similarity was reflected in null effects for either condition. "

(Snell et al., 2019, p.216)



Discussion and Implications

Effective online or blended teacher education

Q4. Implications and Unknowns – What, if any, general principles for effective online or blended teacher education are evident?

- A. What does the evidence suggest about the relative effectiveness of teacher education modalities (including in comparison with the face-to-face mode)?
 - B. What are the main areas of uncertainty and gaps in our present understanding?
-

Relative Effectiveness of Teacher Education Modality

Remote and blended teacher education is a relatively new field of practice and study. There are few studies that enable firm conclusions to be drawn on the relative effectiveness of modes and approaches. We therefore return to our discussion of the question itself that we began near the opening of the **Approaches and Limitations** (Q2) section where we asked whether the focus should be on the ‘medium’ (i.e. the mode and approaches to remote and blended teacher education) or the ‘message’ (i.e. the quality of the teacher education itself with respect to research-informed principles). We concluded that – while there is value in examining the former (especially given recent technological advances and the present circumstances surrounding the Covid-19 pandemic), we must not lose sight of the latter.

Having now reviewed the literature and evidence, we believe that this position still stands. We also note a similar reticence to draw conclusions about modes *per se* – given too little systematic testing and the large variation in the nature and quality of remote and blended programmes – is also evident in the literature:

“We do not believe that the PD described in this study, whether online or face-to-face, is representative of all PD. Yet there is a tendency, especially among educational decision makers, to treat ‘online’ PD as if it represents a particular approach, rather than a delivery vehicle. There is a need for studies that examine many different designs for PD: ‘online’ and ‘face-to-face’ are no more descriptive in the end than ‘workshop’ in terms of understanding the nature of the teaching and learning activities contained within the PD.”

(Fishman et al., 2013, p.436)

We agree. While we hold that there is value in examining ‘delivery vehicles’ and their respective affordances and limitations, it is likely – especially when considering blended or multi-approach teacher education and the growing ubiquity of technology (especially video for conferencing and lesson observation) – that differences in medium will not be the main consideration for teacher education quality: programmes will tend towards a blend of media and approaches and their distinguishing quality factors will relate to teacher education principles and whether these have been achieved rather than the mode.

That said, let us address the question nonetheless: what *does* the evidence suggest about the relative effectiveness of teacher education modes?



The few studies we have to go on (i.e. which allow fair comparison between similar content in different modes or combination of approaches) suggest that there is little difference in effectiveness (Fisher et al., 2010; Fishman et al., 2013; Rock, 2017; Webb et al., 2017; Russell et al., 2019). This includes studies presenting results from randomised experimental designs assessing impact on teachers' student's attainment (Fisher et al., 2010; Fishman et al., 2013). In the closest systematic review to our own, focused on language and literacy PD in the early years, Snell et al. (2019, p.216) conclude 'that Tech PD programs can be as effective as in-person PD programs'. There are tantalising findings about combining components such as coaching and mentoring with video lesson observations, curriculum materials and/or CPD – but with such a limited evidence base, drawing conclusions would be over-reaching.

Design Principles for Teacher Education Modality

Anticipating limitations in the evidence, our approach has included more theory-rich and exploratory sections where we have drawn on reviews and selected empirical pieces to explore what effective remote and blended teacher education might look like in terms of its use of technology and learning design. As we first noted in the introduction, back in 2014 researchers (e.g. see Fishman et al., 2014a; Moon et al., 2014) were in agreement that the field would benefit from scholarship that leads to 'research-based design principles to guide the ongoing development, implementation, and evaluation efforts in online PD'. Six years on, we have been able to report on a larger, but still limited literature. Even in the most highly researched areas, such as around professional learning communities (see Lantz-Andersson et al., 2018), more research is needed. A similar appraisal of the literature on online ITE is provided by Dymont and Downing (2020), as follows:

“... the present research base is fragmented and consists of disparate and unrelated studies that rarely cross reference each other. Given that no particular author is dominating the publishing landscape for ITE, we suspect that, for most authors, these articles represent scholarship of their own teaching and learning, as they report through scholarly publications on a particular innovation or trend in their practice. We do not wish to be overly critical of this fragmented approach to research; we feel confident that these studies would nevertheless have had a small sphere of influence on the practices of the teacher educators who performed the research, also on their local colleagues and, hopefully, other readers of the journal... We believe that there is an urgent need for a more strategic, cohesive, and collaborative approach to researching online ITE. Researchers must be encouraged to work together to establish a shared research agenda that tackles the 'harder-to-reach' variety of research questions. This will require leadership, coordination, and collaboration. If successful, this would allow interdisciplinary teams, with diverse research experience and cross-cultural expertise, to develop broader and more relevant insights than is possible when individual researchers simply profile their own 'innovation' – again and again...”

(Dymont and Downing, 2020, p.329-330)

There were, however, notable exceptions: we did find strong examples which provide the rigorous evidence and theoretical depth needed for progress, including Surrrette and Johnson's (2015) meta-analysis which concludes favourably about the question of whether online environments have the ability to facilitate key professional development principles; Dymont and Downing's (2020) systematic review of the literature on online ITE; the systematic review from Snell et al. (2019) identifying 11 experimental or quasi-experimental studies; and well-designed evaluation studies including Kraft and Hill (2020) and Allen et al. (2015); and several



other pieces which we discussed in previous sections. It is on such reviews and studies that conclusions about effectiveness can start to be founded. We hope we have added to this through our blend of theory application, review synthesis and systematic evidence assessment.

The affordances and limitations section is replete with principles and considerations for the design of remote and blended teacher education. This, however, is almost exclusively based on perspectives from across the literature coupled with interpretations of our own, which enjoy varying levels of evidential support – support that becomes more tenuous as one takes the principle further from the study context and focus from which it originated. Of particular concern for us when it comes to evidential support was the lack of studies that reported student outcomes (in any form whatsoever). Given that a pupil orientation is a feature of effective professional learning, this lack of attention to how teacher education affects pupils impairs our ability to assess both process and impact of teacher education programmes. Evaluating the impact of teacher education on pupils is central to establishing evidence-based principles for effective policy, programmes and practice.

The set of principles, affordances and limitations described in this report, therefore, can be seen as both a statement from the literature of ***working principles for online or blended teacher education design*** at the same time as ***a set of hypotheses and research questions*** that are yet to be established and need to be tested and developed through teacher education research and practice. So, while many plausible principles are apparent, we simply do not have firm evidence back these up at present. However, we do think that the literature suggests that remote and blended teacher education show considerable promise; that they have distinct advantages and disadvantages relative to solely face-to-face approaches; and that they already are and are likely to increasingly become important parts of the teacher education landscape.



Appendix 1 – Methods and Review Protocol

Scoping

Scoping work took place alongside and feeding into the development of a review protocol. The rapid review needed to focus in the most relevant and robust studies that are available and be manageable within the constraints. It was unfeasible to review studies that do not have an explicit focus on CPD modality (i.e. by including all CPD trials and then identifying and assessing modality effects through data extraction and analysis). On the other hand, we recognised that the evidence base for CPD modality specifically was likely to be quite limited. As a result, we refined the focus of the rapid review following scoping work to focus on the areas of the literature most likely to yield experimental or quasi-experimental results to inform practice.

Our scoping work has involved:

Scoping outcomes for the Review of reviews

- Initial **location of key reviews** of CPD/Teacher Education, its modality or both by:
 - Database searches (the search records are included below).
 - Connoisseurial /expert advice
- Developing a set of **research questions** for use in the data extraction and which have also been used to structure our main report.

Scoping outcomes for the Rapid Review

- Development and testing of **search terms** to refine their sensitivity, specificity and precision to identify trials of CPD modality reporting pupil outcomes.
- Development and testing of **inclusion and exclusion** criteria to define the focus of the **rapid review** and ensure resources are targeted to the most pertinent, informative literature.

Rapid Review

A rapid review is a scaled down systematic review, in terms of time, budget and scope. It shares the need to use transparent and reproducible search techniques. It typically seeks to identify, screen and extract data from all relevant studies in a defined area (often focusing on causal evidence of impact from experimental or quasi-experimental work), but reduces the size of that area through narrower inclusion and exclusion criteria in terms of dates, focus and/or quality.

Without pre-existing scoping reviews in this area to help us gauge the extent of evidence, there were dangers of either a) having too many studies to process while adhering to a systematic review protocol or b) there not being enough evidence with a specific focus on CPD modality that is relevant to form a comprehensive account. There was not time – as often happens in a systematic review process – to filter and select studies for inclusion in an iterative fashion, making judgements about the weight of evidence in review areas and setting selection criteria accordingly. As a result, having well-targeted search terms and inclusion and exclusion criteria to focus in on the most relevant and robust evidence has been key to making the rapid review component of this study possible.



In overview, our rapid review involved:

1. Conducting exhaustive, systematic searching, screening and extraction for areas of the literature identified during scoping as most likely to yield experimental or quasi-experimental results to inform teacher CPD practice in remote and blended modes.
2. Using research quality and relevance criteria to identify high quality papers for more detailed data extraction and analysis.
3. Producing a narrative summary of 3, above.

Review of Reviews

A **review of reviews**, or ‘umbrella review’, synthesises and revisits existing reviews in an area to identify key findings in the literature and give a high-level overview. Drawing on existing review work in an area increases efficiency, but reduces transparency, replicability and ability to define the focus of the review as it must work with the specific review questions used in extant studies.

When planning this review, the two main areas of methodological limitation of the scoping and rapid review, as per the discussion above, identified were:

- First, that the need to tightly focus search terms to identify studies with a specific modality focus, combined with the likely scenario that the literature is disparate and/or would provide only limited evidence, would result in lack of coverage of the rich combination of practices that comprise CPD; in other words, we were concerned that the review would be limited to discussing the small number of approaches which had been trialled and not be able to provide a broader account of teacher education more generally.
- Second, we recognised that there were likely to be difficulties translating and applying the evidence to the specifics of STEM Learning’s CPD offer and Covid-19 conditions. We felt that a more theoretical analysis would be needed to apply a) teacher reviews (which are well-based in evidence) and b) teacher education modality reviews which were unlikely to have a large, robust evidence base to draw on, to address our questions.

In short, we felt that the rapid review alone would produce a report which would be too narrowly focused (on the limited causal evidence) and therefore would fail to provide a research-based account to many of the current questions which teacher educators would have at this time. This motivated our second strand, the ‘review of reviews’, or ‘umbrella review’. The ‘umbrella’ review focused on reviews or substantial reports (e.g. government or research organisation) in two areas:

1. Reviews of teacher education (ITE or CPD) effectiveness
2. Reviews of blended and/or online teacher education.

This review had three objectives:

1. identifying remote and blended CPD trials within the studies included *in the reviews* for inclusion the present rapid review, and
2. identifying specific findings within the reviews pertaining specifically to CPD modality
3. drawing out and discussing implications of general teacher education review findings for CPD modality



This second strand of our review gives it more breadth and coverage than a rapid review can efficiently do alone, and puts it in a position to build on and re-interpret existing work, drawing out implications for CPD modality.

In overview, our overall review process consisted of:

- **Searching** - Acquiring data and study information (e.g. search terms and records) from previous reviews and through academic databases. Locating:
 - Relevant systematic reviews and meta-analysis already in the area, including cornerstone reviews of CPD for use in the review of reviews.
 - Trial-based evidence focused on CPD modality in selected areas identified in the scoping work and protocol development.

Overview of Review Process

Running in parallel:

| <u>Rapid Review</u> | <u>Review of Reviews</u> |
|---|--|
| i. Screening - Screening and initial coding using titles and abstracts. Inclusion and exclusion criteria were applied in batches to ensure efficiency. Reasons for exclusion and inclusion were recorded and summarised. ii. Initial appraisal – We reviewed the weight of evidence in our focus areas and finalised the analysis and reporting strategy after this initial quality appraisal, to ensure extraction is focused on the best evidence and within the budget constraints. iii. Extraction – We extracted data from included studies/reviews using a systematic extraction framework which gave an overview of the literature and its main foci and findings. iv. Synthesis – We synthesised the extracted data against our research questions and (therefore) within our report structure. Extracted data from all empirical pieces were brought into the evidence review section and summarised. | a. Initial Screening – We assessed all reviews/meta-analyses for relevance and decided on inclusion/exclusion. b. Study selection – We identified high-quality studies from within reviews, adding these to the rapid review, and assembled a database of the reviews themselves for analysis. c. Extraction – We reviewed the data against our research questions and extracted key information using an analysis framework. i.e. All data from reviews were aligned to the conceptual framework of teacher education principles in Q1 and Q2 sections and summarised therein. d. Synthesis – We synthesised evidence within each section using our questions and conceptual framework. We conducted joint analysis as a team to draw out implications and test assumptions. |



Search Term Record

| Database | Search String / details | Results |
|--|--|--|
| <i>Web of Science</i> (10 collections) | (TI=(teach* OR educat* OR profession*) AND AB=(educat*OR learn* OR CPD OR train* OR develop*) AND TI=(review OR "meta-analysis" OR synthesis OR Evaluation OR Trial OR Impact OR effect) AND AB=(modality OR mode OR online OR "face-to-face" OR blended OR remote OR virtual OR distance)) AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=2005-2020 | 3,314 initial 1,400 after exclusion by WoS categories |
| <i>Proquest</i> (9 databases see record) | TI: (teach* OR educat* OR profession*) AND TI: (educat* OR learn* OR CPD OR train* OR develop*) AND TI: (modality OR mode OR online OR "face-to-face" OR blended OR remote OR virtual OR distance) AND AB: (review OR "meta-analysis" OR synthesis OR Evaluation OR Trial OR Impact OR effect) Language: English Date: 2010 onwards | 3,638 results |
| Supplementary Searches | | |
| <i>Google Scholar</i> | allintitle: (teacher OR educator OR practitioner) (modality OR mode OR online OR "face-to-face" OR blended OR remote OR virtual OR distance) Date: 2005+ | 6,390 results (Limited to first 1000 results) |
| <i>Google Scholar</i> | allintitle: (teacher OR educator OR practitioner) (modality OR mode OR online OR "face-to-face" OR blended OR remote OR virtual OR distance) (trial OR RCT OR random OR experiment OR randomised OR quasi-experiment) | 24 results (19 retrieved) |
| <i>Google Scholar</i> | 'Pearl growing' using citation data for 15 relevant papers | 839 results (64 retrieved) |
| <i>Ingenta Connect</i> | Title, Keywords or Abstract contains: teacher AND (development OR learning OR training) AND (modality OR mode OR online OR "face to face" OR blended OR remote OR virtual OR distance) AND (review OR "meta-analysis" OR synthesis OR Evaluation OR Trial OR Impact OR effect) | 193 results (Initial screening on title – 26 met criteria, 24 items retrieved) |
| <i>JSTOR</i> | ((ti:(teach* OR educat* OR profession*)) AND ti:(educat* OR learn* OR CPD OR train* OR develop*)) AND ti:(modality OR mode OR online OR "face-to-face" OR blended OR remote OR virtual OR distance)) Subject: Education Date: 2010 onwards | 214 results (Initial screening on title – 17 results selected; 16 results retrieved) |



Record of Search Results and Screening

Search Databases

| | | |
|-----------------------|--------------|--|
| Web of Science | 1,400 | |
| Proquest | 3,638 | |
| Google Scholar | 1000 | |
| Google Scholar | 24 | |
| Goole Scholar (pearl) | 839 | |
| Ingenta Connect | 193 | 7354 records, 5 databases, dozens of collections |
| JSTOR | 214 | |
| Other Additions | 46 | |
| Total Records | 7,354 | |

| | Exclusion | | | | | | | | | Retained | |
|------------------------------------|-----------|----------|--------|----------------------|-----------|------------------|----------|--------------|-------------|----------|-----------|
| | Before | Not 3-18 | Not TD | No Remote PD Element | Duplicate | No pupil outcome | Pre-2005 | Inaccessible | Not English | | Total Exc |
| After round 1 - title screening | 7354 | | | 5,638 | | | | | | 5,638 | 1,716 |
| After round 2 - title and abstract | 1,716 | 160 | 515 | 52 | | | | | | 727 | 989 |
| After round 3 -full text | 989 | 28 | 50 | 32 | 45 | 749 | 5 | 4 | 3 | 916 | 73 |

Late Entries

| | | | | | | | | | | | | |
|----------------------|----|--|--|--|---|--|--|--|--|---|---|----|
| Reviews and Reports | 25 | | | | 6 | | | | | 6 | 3 | 22 |
| Empirical Studies | 25 | | | | 2 | | | | | 2 | 1 | 24 |
| Background and Wider | 23 | | | | 4 | | | | | 4 | 0 | 19 |

Total 65



Inclusion and Exclusion Criteria

| <i>Area</i> | <i>Include/Exclude</i> | <i>When applied?</i> |
|-----------------------------|--|------------------------------|
| 1. Date | Include – Studies conducted in or after 2005 | Searching |
| 2. Learners | Include – All age 3-18 (Inc. SEN and mainstream) | Screening title and abstract |
| 3. Teacher learning focus | Include – Substantial focus on teacher learning and/or improving pupil outcomes <i>via</i> teacher learning. There must be a teacher learning element. Include – Teachers defined as all subjects, all career states (qualified, unqualified), all statuses (including teaching assistants). | Screening title and abstract |
| 4. Non-face-to-face element | Include – All empirical and theoretical pieces which present findings about a mode of teacher learning other than face-to-face. This can be a trial of an online or blended CPD programme. It would ideally include a comparison of face-to-face and another mode of teacher learning (but an evaluation of a single remote or blended mode is acceptable). Also Include – Reviews, meta-analyses or reports – if they are focused on effective CPDL or ITE and have <u>potential</u> implications (either due to sub-results or by inference from principles) for remote or blended teacher education. | Screening full text |
| 5. Pupil outcomes | Include – All studies included in the main review must present some empirical evidence about the impact of the teacher learning on pupil outcomes. This is to be interpreted broadly and can include, e.g. classroom observations or other data collections reporting pupil behaviours, perspectives and/or learning outcomes. | Screening full text |
| 6. Background interest | Include – Although outside of the main review, where a paper is thought by the researcher to have value for background and discussion sections, it was retained in a marked folder. All studies included in the main ‘Evidence’ section meet eligibility criteria 1-5, above. Additional, non-systematic searches were undertaken to identify further pieces for the background section. | Screening full text |



Appendix 2 – References and Review Database

Teacher Education, Professional Development and Learning Reviews (13)

Carter, A. (2015). Carter review of initial teacher training (ITT). Available:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/399957/Carter_Review.pdf

Cordingley, P., Greany, T., Crisp, B., Seleznyov, S., Bradbury, M., & Perry, T. (2018). Developing Great Subject Teaching: Rapid evidence review of subject-specific continuing professional development in the UK. London

Cordingley, P., Higgins, S., Greany, T., Buckler, N., Coles-Jordan, D., Crisp, B., ... & Coe, R. (2015). Developing great teaching: lessons from the international reviews into effective professional development.

Cordingley, P., Higgins, S., Greany, T., Crisp, B., Araviaki, E., Coe, R. & Johns, P. (2020). Developing Great Leadership of CPDL. Retrieved from <http://www.curee.co.uk/node/5214>

Le Cornu, R. (2015). Key components of effective professional experience in initial teacher education in Australia. Australian Institute for Teaching and School Leadership, Melbourne. Available: https://www.aitsl.edu.au/docs/default-source/default-document-library/aitsl_key-components-of-effective-professional-experience.pdf?sfvrsn=aec9ec3c_0

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development.

Deans for Impact. (2016). Practice with purpose: The emerging science of teacher expertise. Austin, TX: Deans for Impact.

Fletcher-Wood, H., & Zuccollo, J. (2020). The effects of high-quality professional development on teachers and students: A rapid review and meta-analysis. Wellcome Trust

Hill, H. C., Lynch, K., Gonzalez, K. E., & Pollard, C. (2020). Professional development that improves STEM outcomes. *Phi Delta Kappan*, 101(5), 50-56.

Lauer, P. A., Christopher, D. E., Firpo-Triplett, R., & Buchting, F. (2014). The impact of short-term professional development on participant outcomes: A review of the literature. *Professional development in education*, 40(2), 207-227.

OECD (2019), A Flying Start: Improving Initial Teacher Preparation Systems, OECD Publishing, Paris. Available: <https://doi.org/10.1787/cf74e549-en>

Rogers, S., Brown, C., & Poblete, X. (2020). A systematic review of the evidence base for professional learning in early years education (The PLEYE Review). *Review of Education*, 8(1), 156-188.

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). Teacher professional learning and development: Best evidence synthesis iteration. Ministry of Education.



Remote or Blended Professional Development and Learning Reviews (9)

- Burns, M. (2011). Distance education for teacher training: Modes, models and methods. Burns.–Washington: Education Development Center Inc.
- Dyment, J. E., & Downing, J. J. (2020). Online initial teacher education: a systematic review of the literature. *Asia-Pacific Journal of Teacher Education*, 48(3), 316-333.
- Keengwe, J., & Kang, J. J. (2013). A review of empirical research on blended learning in teacher education programs. *Education and Information Technologies*, 18(3), 479-493.
- Lantz-Andersson, A., Lundin, M., & Selwyn, N. (2018). Twenty years of online teacher communities: A systematic review of formally-organized and informally-developed professional learning groups. *Teaching and Teacher Education*, 75, 302-315.
- Macià, M., & García, I. (2016). Informal online communities and networks as a source of teacher professional development: A review. *Teaching and teacher education*, 55, 291-307.
- Owston, R., Wideman, H., Murphy, J., & Lupshenyuk, D. (2008). Blended teacher professional development: A synthesis of three program evaluations. *The Internet and Higher Education*, 11(3-4), 201-210.
- Saifuddin, K. M., & Strange, M. H. (2016, October). School teacher professional development in online communities of practice: A systematic literature review. In *European Conference on e-Learning* (p. 605). Academic Conferences International Limited.
- Snell, E. K., Hindman, A. H., & Wasik, B. A. (2019). A review of research on technology-mediated language and literacy professional development models. *Journal of Early Childhood Teacher Education*, 40(3), 205-220.
- Surrette, T. N., & Johnson, C. C. (2015). Assessing the ability of an online environment to facilitate the critical features of teacher professional development. *School Science and Mathematics*, 115(6), 260-270.



Empirical Pieces (24)

| Reference | Abstract/Summary |
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| <p>Allen, J. P., Hafen, C. A., Gregory, A. C., Mikami, A. Y., & Pianta, R. (2015). Enhancing secondary school instruction and student achievement: Replication and extension of the My Teaching Partner-Secondary intervention. <i>Journal of Research on Educational Effectiveness</i>, 8(4), 475-489.</p> | <p>MyTeaching Partner-Secondary (MTP-S) is a web-mediated coaching intervention, which an initial randomized trial, primarily in middle schools, found to improve teacher-student interactions and student achievement. Given the dearth of validated teacher development interventions showing consistent effects, we sought to both replicate and extend these findings with a modified version of the program in a predominantly high school population, and in a more urban, socio-demographically diverse school district. MTP-S produced substantial gains in student achievement across 86 secondary school classrooms involving 1,194 students. Gains were robust across subject areas and equivalent to moving the average student from the 50th to the 59th percentile in achievement scores. Results suggest that MTP-S can enhance student outcomes across diverse settings and implementation modalities.</p> |
| <p>Ascetta, K., Harn, B., & Durán, L. (2019). Comparing Self-Reported and Performance-Based Online Feedback on Early Childhood Teachers' Implementation of Language Strategies. <i>Early Childhood Education Journal</i>, 47(3), 353-365.</p> | <p>This professional development (PD) study examined the effect of feedback type on changing preschool teachers' use of language enhancement strategies and language outcomes for children. We included 21 Head Start teachers and 107 children. We randomized classrooms to PD feedback condition: (a) self-reported or (b) observed use of strategies. All teachers completed online learning modules on language enhancement strategies (i.e. open-ended questions, self-talk, repetition, expansion, and narration) and teacher self-monitoring. After completing the PD, teachers were provided weekly, individualized feedback based on their submissions of: (a) self-reported, or (b) observed performance (via 10-min video) of their use of language enhancement strategies. Results suggested that the PD experience (less than 8 weeks, 1 h per week) increased teachers' frequency in using language enhancement strategies (performance, Hedges' $g = 0.65$; self-report, Hedges' $g = 1.43$) across condition, with no significant differences by condition. Additionally, children demonstrated mean gains in expressive vocabulary and overall language skills. We believe that this brief, but targeted PD experience, warrants further research to explore the impact of using self-reported feedback with a larger sample. Determining more efficient and effective PD approaches will enable the field to better meet the needs of teachers and improve outcomes for children.</p> |
| <p>Dash, S., Magidin de Kramer, R., O'Dwyer, L. M., Masters, J., & Russell, M. (2012). Impact of online professional development on teacher quality and student achievement in fifth grade mathematics. <i>Journal of research on technology in education</i>, 45(1), 1-26.</p> | <p>Despite the ever-increasing number of online professional development (OPD) programs, relatively few studies have been conducted to examine the efficacy of such programs for teachers and students. This manuscript presents findings from an impact study of OPD courses in fractions, algebraic thinking, and measurement on 79 fifth grade teachers' pedagogical content knowledge and pedagogical practices as well as their students' mathematics achievement. The OPD courses were offered one course per semester for three semesters, and each course comprised 1 week of orientation and 6 weeks of course content. Overall, teachers participated in more than approximately 70 hours of OPD. The research findings showed that teachers who had been randomly assigned to the experimental group had significantly greater gains in scores for pedagogical content knowledge and pedagogical practices than teachers in the control group. Nevertheless, the positive changes in teacher outcomes did not translate to any meaningful differences in students' mathematics achievement. (Keywords: teacher quality, online professional development, elementary education, mathematics achievement)</p> |
| <p>Fisher, J. B., Schumaker, J. B., Culbertson, J., & Deshler, D. D. (2010). Effects of a computerized professional</p> | <p>Effects of a computerized professional development (PD) program for a concept teaching routine were investigated in two studies. For each, teachers were randomly assigned to either a virtual workshop group that used a multimedia software program for PD or an actual workshop group that participated in a live PD session. In Study 1, the teachers' knowledge about the routine and planning for the routine significantly improved</p> |



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| <p>development program on teacher and student outcomes. <i>Journal of Teacher Education</i>, 61(4), 302-312.</p> | <p>after completing either workshop; no significant differences were found between the groups. Both teacher groups were satisfied with the PD. In Study 2, the teachers' performance of the routine in their classrooms improved, as did student performance on tests of concept knowledge. Students were satisfied with the instruction provided by both groups of teachers. No differences were found between the post-test scores earned by the teacher groups or by students of the teachers. Implications regarding computerized PD for teachers are discussed.</p> |
| <p>Fishman, B., Konstantopoulos, S., Kubitskey, B. W., Vath, R., Park, G., Johnson, H., & Edelson, D. C. (2013). Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. <i>Journal of teacher education</i>, 64(5), 426-438.</p> | <p>This study employed a randomized experiment to examine differences in teacher and student learning from professional development (PD) in two modalities: online and face-to-face. The study explores whether there are differences in teacher knowledge and beliefs, teacher classroom practice, and student learning outcomes related to PD modality. Comparison of classroom practice and student learning outcomes, normally difficult to establish in PD research, is facilitated by the use of a common set of curriculum materials as the content for PD and subsequent teaching. Findings indicate that teachers and students exhibited significant gains in both conditions, and that there was no significant difference between conditions. We discuss implications for the delivery of teacher professional learning.</p> |
| <p>Fishman, B., Fischer, C., Kook, J. F., Levy, A., Jia, Y., Eisenkraft, A. ... McCoy, A. (2014b). Professional development for the redesigned AP biology exam: Teacher participation patterns and student outcomes. Paper presented at the American Education Research Association Annual Meeting, Philadelphia, PA.</p> | <p>In an era of high-stakes accountability and widespread calls for improved student performance in science, technology, engineering, and math (National Research Council, 2002), it is critical that we also focus on how to support and enhance teachers' learning. Teachers have long been understood to play a key role in the performance of students (e.g., Nye, Konstantopoulos, & Hedges, 2004). Educational policy makers have become increasingly focused on "value added" approaches to gauging teacher performance (McCaffrey, Lockwood, Koretz, Louis, & Hamilton, 2004), which attempt to directly link the contribution of individual teachers to their students' subsequent test performance, in both the near and far term. We take the position that, no matter what one thinks about the current testing and evaluation regime, it makes sense to conduct research to improve our understanding of how to support teachers' ongoing learning and efforts to improve their practice related to student outcomes. This paper reports on a study of teacher learning in a context that is especially apt in the current policy climate – how teachers learn to teach a curriculum associated with a recently-revised high stakes examination. In particular, we report early results from a study of high school teachers learning to teach the revised Advanced Placement Biology curriculum as they prepare students for a high-stakes examination. We examine the role of professional development in supporting teachers' learning to use the revised Advanced Placement Biology curriculum, and the relationship between teachers' professional development choices and subsequent student performance on the Advanced Placement Biology examination.</p> |
| <p>Frumin, K., Dede, C., Fischer, C., Foster, B., Lawrenz, F., Eisenkraft, A., ... & McCoy, A. (2018). Adapting to large-scale changes in Advanced Placement Biology, Chemistry, and Physics: the impact of online teacher communities. <i>International Journal of Science Education</i>, 40(4), 397-420.</p> | <p>Over the past decade, the field of teacher professional learning has coalesced around core characteristics of high quality professional development experiences (e.g. Borko, Jacobs, & Koellner, 2010. Contemporary approaches to teacher professional development. In P. L. Peterson, E. Baker, & B. McGaw (Eds.), <i>International encyclopedia of education</i> (Vol. 7, pp. 548–556). Oxford: Elsevier.; Darling-Hammond, Hyler, & Gardner, 2017. <i>Effective teacher professional development</i>. Palo Alto, CA: Learning Policy Institute). Many countries have found these advances of great interest because of a desire to build teacher capacity in science education and across the full curriculum. This paper continues this progress by examining the role and impact of an online professional development community within the top-down, large-scale curriculum and assessment revision of Advanced Placement (AP) Biology, Chemistry, and Physics. This paper is part of a five-year, longitudinal, U.S. National Science Foundation-funded project to study the relative effectiveness of various types of professional development in enabling teachers to adapt to the revised AP course goals and exams. Of the many forms of professional development our research has examined, preliminary analyses indicated that participation in the College Board's online AP Teacher Community (APTC) – where teachers can discuss teaching strategies, share resources, and connect with each other – had positive, direct, and statistically significant association with teacher self-reported shifts in practice</p> |



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| | <p>and with gains in student AP scores (Fishman et al., 2014b). This study explored how usage of the online APTC might be useful to teachers and examined a more robust estimate of these effects. Findings from the experience of AP teachers may be valuable in supporting other large-scale curriculum changes, such as the U.S. Next Generation Science Standards or Common Core Standards, as well as parallel curricular shifts in other countries.</p> |
| <p>Goldenberg, L., Culp, K., Clements, M., Anderson, A., & Pasquale, M. (2014). Online professional development for high-school biology teachers: Effects on teachers' and students' knowledge. <i>Journal of Technology and Teacher Education</i>, 22(3), 287-309.</p> | <p>One chronic challenge facing professional development providers is the need to convene and support groups of role-alike K-12 teachers who require similar kinds of discipline- and grade-level-specific training. Online courses have become an increasingly common way to meet this challenge. This article reports on a randomized control trial that tested the impact of one such course on teachers of high-school biology and their students. The course, Teaching High School Biology, sought to improve teachers' content knowledge, pedagogical knowledge, and knowledge of how to integrate digital media resources into their teaching. The course was developed by WGBH's Teachers' Domain and delivered by PBS Teacher- Line. The study finds that teacher participation in the course had a significant impact on teacher knowledge but did not improve student outcomes. The authors note that the course sought to help teachers learn about inquiry-oriented teaching methods that are difficult to implement in ways that have a significant impact on student learning. Future research would benefit by attending to whether and how an online professional development course aligns with local curricula and policy priorities that shape participants' instruction.</p> |
| <p>Griffin, C. C., Dana, N. F., Pape, S. J., Algina, J., Bae, J., Prosser, S. K., & League, M. B. (2018). Prime online: Exploring teacher professional development for creating inclusive elementary mathematics classrooms. <i>Teacher education and special education</i>, 41(2), 121-139.</p> | <p>Enhancing all students' academic performance continues to be a national priority, and although achievement gains have been made overtime, shortfalls in mathematics learning for students with disabilities (SWD) remain. Research reveals that a substantial portion of the variability in students' mathematics achievement gains is due to the teacher. To address the need for teacher professional development (PD) in mathematics for SWD and other struggling mathematics learners, we designed and studied Prime Online—a yearlong, online, PD program with support from an Institute of Education Sciences (IES) Goal 2 Development and Innovation research grant. In this article, the development process and an exploratory study are discussed. Study findings suggest that Prime Online positively influenced general and special education teachers' reported beliefs and practices, and their learning of mathematics content for teaching, and generated high teacher satisfaction ratings. No difference in the performance of SWD on a state accountability measure of mathematics was found. Implications for further research are discussed.</p> |
| <p>Hoffman, J. A., Schmidt, E. M., Arguello, D. J., Eyllon, M. N., Castaneda-Sceppa, C., Cloutier, G., & Hillman, C. H. (2020). Online preschool teacher training to promote physical activity in young children: A pilot cluster randomized controlled trial. <i>School Psychology</i>.</p> | <p>This study tested the Wellness Enhancing Physical Activity in Young Children (WE PLAY) program, a 4-week online preschool teacher training, on children's moderate-to-vigorous physical activity (MVPA). In this cluster RCT, six Head Start preschools were randomized to an intervention and comparison group. Children's MVPA was measured using accelerometers at pre- and post-test. The magnitude of the difference in MVPA between groups at post-test was small, but in the expected direction: \bar{x} min/hour \bar{x} 1.60, 95% CI [-0.97, 4.18], p \bar{x} .22, Cohen's d \bar{x} 0.32. We observed a pre/post within group increase in average minutes per hour of MVPA in school with a medium effect size for the intervention group: \bar{x} mean min/hour \bar{x} 2.09, 95% CI [0.51, 3.67], p \bar{x} .0096, Cohen's d \bar{x} 0.42. An increase was not seen for the comparison group: \bar{x} mean min/hour \bar{x} 0.44, 95% CI [-0.70, 1.59], p \bar{x} .45, Cohen's d \bar{x} 0.07. WE PLAY children in 6 hr/day programs gained 63 min of MVPA per week in school, providing preliminary evidence of the benefits of WE PLAY on children's physical activity levels. WE PLAY deserves further testing with larger groups of children and teachers.</p> |
| <p>Kraft, M. A., & Hill, H. C. (2018). Developing Ambitious Mathematics Instruction Through Web-Based Coaching: A Randomized Field Trial. <i>American Educational Research Journal</i>, 0002831220916840.</p> | <p>This article describes and evaluates a web-based coaching program designed to support teachers in implementing Common Core-aligned math instruction. Web-based coaching programs can be operated at relatively lower costs, are scalable, and make it more feasible to pair teachers with coaches who have expertise in their content area and grade level. Results from our randomized field trial document sizable and sustained effects on both teachers' ability to analyze instruction and on their instructional practice, as measured by the Mathematical Quality of Instruction instrument and student surveys. However, these improvements in instruction did not result in corresponding increases in math test scores as measured by state standardized tests or interim assessments. We discuss several possible explanations for this pattern of results.</p> |



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| <p>Marquez, B., VinCent, C., Marquez, J., Pennefather, J., Smolkowski, K., & Sprague, J. (2016). Opportunities and challenges in training elementary school teachers in classroom management: Initial results from classroom management in action, an online professional development program. <i>Journal of Technology and Teacher Education</i>, 24(1), 87-109.</p> | <p>Classroom management remains a challenge for many teachers. The approach and delivery of professional development (PD) in classroom management may determine how well teachers are able to apply evidence-based approaches in their classrooms. We use existing literature to identify the key features that make in-service PD effective and present them as the defining features of a recently developed PD program, Classroom Management in Action, which blends online technology, evidence-based practice in positive behavior support, video modeling, self-paced/step-by-step activities, and tools for aiding and measuring fidelity and behavioral outcomes. We report results from studies documenting the program's social validity, the psychometrics of its online behavioral assessment tool, and its effectiveness based on an initial pilot test using a randomized controlled field trial involving 101 classrooms. We offer recommendations for future research on PD in classroom management and implications for policy and practice.</p> |
| <p>Rock, H. M. (2017). The effect of face-to-face versus online pedagogy-based professional development on student learning outcomes (Doctoral dissertation, Grand Canyon University).</p> | <p>The purpose of this quantitative retrospective causal-comparative study was to determine to what extent the form of professional development (face-to-face or online) or the level of instruction (elementary or high school) has on classroom teaching practices as measured by student learning outcomes. The first research question sought to determine to what extent the form of professional development affects classroom teaching practices as measured by student learning outcomes. The second research questions sought to determine to what extent the level of instruction affects classroom teaching practices as measured by student learning outcomes. The sample was 432 Ohio teachers who participated in the Ohio Performance Assessment Pilot Project. There were 105 teachers who engaged in face-to-face professional development and 327 teachers who engaged in online professional development. There were 216 elementary teachers and 216 high school teachers. An independent samples t-test with a probability level of $p = 0.05$ was used to determine the differences in student learning outcomes by form of professional development and level of instruction. This study found there is no statistically significant difference between teachers who engaged in face-to-face professional development ($M = 0.519$) or online ($M = .467$) or teachers who taught elementary ($M = 0.524$) or high school ($M = 0.493$). These findings suggest when the content of professional development is comparable, the form of professional development and the level of instruction have minimal effect on student learning outcomes.</p> |
| <p>Rosenberg, N. E., Artman-Meeker, K., Kelly, E., & Yang, X. (2020). The Effects of a Bug-in-Ear Coaching Package on Implementation of Incidental Teaching by Paraprofessionals in a K-12 School. <i>Journal of Behavioral Education</i>, 1-24.</p> | <p>Paraprofessionals play a critical role in the instruction of students with disabilities and yet they often receive inadequate training in using evidence-based teaching strategies. A promising avenue for improving paraprofessional training is distant bug-in-ear coaching (BIE), where a paraprofessional receives in-the-moment coaching on a teaching strategy from a coach at a different location. This study examined a BIE coaching package to support paraprofessionals in using incidental teaching for teaching self-advocacy skills to students with disabilities. The package included an initial individual didactic teaching session followed by distance BIE coaching. A multiple-baseline across participants design was used to assess the impact of the intervention on both the skills of the paraprofessionals and on student acquisition of self-advocacy statements. BIE coaching was associated with increases in both the accuracy and rate of incidental teaching trials and with use of self-advocacy statements by the students with disabilities.</p> |
| <p>Russell, M., Carey, R., Kleiman, G., & Venable, J. D. (2009). Face-to-face and online professional development for mathematics teachers: A comparative study. <i>Journal of asynchronous learning networks</i>, 13(2), 71-87.</p> | <p>The study compared the effects of a professional development course delivered in an online and a face-to-face format. The effects examined included changes in teachers' pedagogical beliefs, instructional practices, and understanding of teaching number-sense and related mathematical concepts. The study randomly assigned participants to either the online or the face-to-face format and employed the same instructors, reading material, and instructional activities for both formats of the course. Both formats of the course were also delivered over the same eight-week period and required participants to invest approximately the same amount of time each week engaging in learning activities. Both formats of the course showed significant impacts on teachers' mathematical understanding, pedagogical beliefs, and instructional practices. Consistent with prior</p> |



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| | research on online versus face-to-face instruction, the positive outcomes were comparable across both formats. Interestingly, teachers who participated in the online course reported that they were more willing to take courses in the future online than did teachers in the face-to-face condition. Further research is needed to determine whether this finding is limited to self-selected teachers, the specifics of this course, or other factors that limit generalizability. |
| Shaha, S., & Ellsworth, H. (2013). Multi-state, quasi-experimental study of the impact of internet-based, on-demand professional learning on student performance. <i>International Journal of Evaluation and research in Education</i> , 2(4). | This multi-State, quasi-experimental study reflects the quantification of comparative gains in math and reading performance on standardized assessments. We contrasted performance in consecutive years pre-versus-post for students of teachers actively participating in an Internet-based, on-demand professional development (PD) program with their respective districts, thus normalizing for uncontrolled educational and socioeconomic variables. A random sample of 169 schools was analyzed representing teachers with a minimum high-participation level in PD. Results showed that students of participating teachers experienced 18.9% increases ($p < .001$) in math scores versus 4.2% ($p < .01$) for their districts, and 15.3% increases ($p < .001$) in reading versus 2.5% ($p < .01$) for their districts, equating to statistically significant 4.2 fold ($p > .001$) and 6.1 ($p > .001$) fold advantages, respectively. Findings support the high-participation use of Internet-based, on-demand professional learning for improving teacher effectiveness to impact student performance. |
| Shaha, S. H., Glassett, K. F., & Copas, A. (2015). The impact of teacher observations with coordinated professional development on student performance: A 27-state program evaluation. <i>Journal of College Teaching & Learning (TLC)</i> , 12(1), 55-64. | The impact of teacher observations in alignment with professional development (PD) on teacher efficacy was quantified for 292 schools in 110 districts within 27 U.S. States. Teacher observations conducted by school leaders or designated internal coaches were coordinated with PD offerings aligned with intended teacher improvements. The PD involved throughout was an online, on-demand system teachers accessed as convenient with a range of PD assistance regarding teaching techniques and participative teacher/user interactive communities for collaboratively posting and downloading PD-related materials. Results indicate that systemic teacher observations, coupled with aligned PD, resulted in significantly improved student achievement in reading and math on standardized assessments. |
| Shaha, S. H., Glassett, K., & Copas, A. (2015). Sustaining Student Gains from Online On-Demand Professional Development. <i>Journal of International Education Research</i> , 11(3), 163-172. | A multi-State, quasi-experimental study was conducted as a longitudinal, two-year follow-up of participation in an online, on-demand professional development (PD) program. The purpose was to ascertain whether student gains were sustained in a second year of PD participation. Data verified gains in Year 1 versus Pre-PD baseline, with continued gains in Year 2 atop those achieved in year 1 of PD participation, reflecting a positive trend and continued advantage over non-PD schools in the same districts. Results showed that student in PD schools gained 7.7% ($p < .01$) more in Math in year 2 atop 18.9% ($p < .001$) gains from year 1, versus gains of 0.5% (ns) and 4.2% ($p < .01$) for non-PD schools in the same districts. Similarly, students in the PD schools gained 10.2% ($p < .01$) more in Reading in year 2 atop 18.9% ($p < .001$) gains from year 1, versus gains of 0.5% (ns) and 4.2% ($p < .01$) for non-PD schools in the same districts. Total gains from baseline for PD schools were 28.1% ($p < .001$) in Math for PD schools versus 4.7% ($p < .01$) for the same districts collectively, and 30.2% ($p < .001$) in Reading for PD schools versus 6.0% ($p < .01$) for the same districts collectively. Findings support the high-participation use of Internet-based, on-demand professional learning for improving teacher effectiveness and sustained impacts on student performance. |
| Shaha, S., Glassett, K., Copas, A., & Ellsworth, H. (2015). Title I Schools: The Student-Based Impact of Online, On-Demand Professional Development on Educators. <i>Contemporary Issues in Education Research</i> , 8(4), 227-234. | Title I students remain among the most challenging population for achieving significant gains in academic performance and standardized test scores. This multi-state, quasi-experimental, pre-versus-post study reflects the comparative Title I gains for math and reading scores for teachers participating in an online, on-demand professional development program school-wide versus nonparticipating Title I in their respective districts as benchmarks. Average Title I gains in reading were 4.8% ($p < .001$) versus 0.1% (ns) in the non-participating Title I schools. For math scores, non-participating Title I schools in the districts saw a decline of 5.9% ($p < .001$), while Title I schools participating in the professional development experienced a gain of 7.3% ($p < .001$). Conclusions are that significant advantages for Title I students are achieved when teachers participate actively in such a high impact, high accessibility professional development program. |



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| <p>Shaha, S., Glassett, K., Copas, A., & Huddleston, T. L. (2016). Maximizing educator enhancement: Aligned seminar and online professional development. <i>Contemporary Issues in Education Research (CIER)</i>, 9(1), 15-22.</p> | <p>Professional development and learning has a long history in seminar-like models, as well as in the more educator personal delivery approaches. The question is whether an intentionally coordinated, integrated combination of the two PDL approaches will have best impacts for educators as quantified in improved student performance. Contrasts between baseline and Post-Program performance levels showed 19% gains in Reading and 24% gains in Math, significantly beyond expectation. Analyses for Title 1 schools showed significant shrinkage of performance gaps with contrasted non-Title 1 schools. These gains outpaced those found for either PDL approach alone, indicating that educational leaders will be wise to undertake implementation of intentionally aligned and coordinated approaches combining PDL Seminars with online, on-demand PDL.</p> |
| <p>Shaha, S. H., Glassett, K. F., & Ellsworth, H. (2015). Long-term impact of on-demand professional development on student performance: A longitudinal multi-state study. <i>Journal of International Education Research (JIER)</i>, 11(1), 29-34.</p> | <p>The long-term effects of Professional Development (PD) on educators' ability to affect student performance remain virtually unstudied. This quasi-experimental, longitudinal study compared student achievement scores from 25 states and 78 school districts over multiple years for schools whose teachers used an online, on-demand professional development offering. The objective was to evaluate to what degree student scores might improve, decline, or plateau with participation in professional development over multiple years. Results showed significant gains in student performance across the number of years of participation, with significant continuation in growth across years. Findings validate a significant predictive relationship between the number of years educators participated in PD and improvements quantified in student performance. Inferences of findings to other PD approaches or offerings, or other student or educator populations or settings are discussed.</p> |
| <p>Walker, A., Recker, M., Ye, L., Robertshaw, M. B., Sellers, L., & Leary, H. (2012). Comparing technology-related teacher professional development designs: A multilevel study of teacher and student impacts. <i>Educational technology research and development</i>, 60(3), 421-444.</p> | <p>This article presents a quasi-experimental study comparing the impact of two technology-related teacher professional development (TTPD) designs, aimed at helping junior high school science and mathematics teachers design online activities using the rapidly growing set of online learning resources available on the Internet. The first TTPD design (tech-only) focused exclusively on enhancing technology knowledge and skills for finding, selecting, and designing classroom activities with online resources, while the second (tech-pbl) coupled technology knowledge with learning to design problem-based learning (PBL) activities for students. Both designs showed large pre-post gains for teacher participants (N = 36) in terms of self-reported knowledge, skills, and technology integration. Significant interaction effects show that teachers in the tech-pbl group had larger gains for self-reported knowledge and externally rated use of PBL. Three generalized estimating equation (GEE) models were fit to study the impact on students' (N = 1,247) self reported gains in behavior, knowledge, and attitudes. In the resulting models, students of tech-pbl teachers showed significant increases in gain scores for all three outcomes. By contrast, students of tech-only teachers showed improved gains only in attitudes.</p> |
| <p>Webb, D. C., Nickerson, H., & Bush, J. B. (2017, March). A comparative analysis of online and face-to-face professional development models for CS education. In <i>Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education</i> (pp. 621-626).</p> | <p>This paper compares student outcomes from 75 K-12 teachers who participated in either online, blended, or face-to-face professional development design to support teacher implementation of a programming curriculum during the regular school day. The results are based on survey responses collected over two years from 4,832 students. With only one exception, the results showed no negative student outcomes when comparing student survey results from teachers who participated in online professional development compared to students of teachers who participated in face-to-face professional development. Students who had teachers who participated in face-to-face professional development, however, expressed stronger interest in designing their own games at home. These results suggest that online professional development that is designed to support K-12 teacher classroom implementation of CS education curricula is a viable model with respect to student outcomes. Recommendations for the design of online curricula for CS education are discussed.</p> |
| <p>Weschke, B., Barclay, R. D., & Vandersall, K. (2011). <i>Online Teacher Education: Exploring the Impact of a Reading and Literacy Program on</i></p> | <p>This study presents findings from an investigation of the impact of teachers who graduated from a fully online master's degree program with training in pedagogy and a content-specialization in elementary reading and literacy (ERL) on reading achievement in a large urban public school system in the northwestern United States. The research team used a non-equivalent group design and matched pairs of teachers based on degree, grade-level taught, and teaching experience to construct the study on three years of student and teacher data. The study consisted of 70</p> |



Student Learning. *Journal of Asynchronous Learning Networks*, 15(2), 22-43.

teachers and 3,828 student observations. Hierarchical linear modeling was employed to understand the teachers' effects on student learning over time. Results indicate there was a significant positive effect of the ERL on student achievement. Broadly, this study is an example of a serious attempt to ascertain the impact of a high demand and fully online program on the community where graduates are employed. More narrowly, these results support the view that a fully online program aimed at training teachers can provide opportunities for those teachers to obtain the pedagogical content knowledge that can positively influence instructional effectiveness.

Background Pieces (19)

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