Paul Hamlyn Foundation

Blended approaches to teacher continuing professional development:

a scoping review

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Executive summary

Since the start of the Covid-19 pandemic, an increasing amount of teacher continuous professional development (CPD) has moved online. What first started out of necessity is gaining increasing traction among the teaching profession as providers and practitioners discover the advantages of online access, including better coverage in remote locations and easier access to specialist training. However, online learning has also been associated with higher dropout and lower engagement rates whilst face-to-face teaching can increase motivation.

When well designed, blended approaches can combine the advantages of both approaches while minimising their disadvantages or challenges. However, when designed or executed inappropriately, negative properties can of course also be exacerbated.

To ensure that blended learning is designed most effectively, it is important to understand what works (better) and what does not work (as well) in a blended CPD environment.

This review defines CPD as "structured, facilitated activity for teachers intended to increase their teaching ability" (Sims et al., 2021) and blended CPD as formats that combine face-to-face and online elements (Wong et al., 2014).

The aim of this literature review is not to draw final conclusions about effective approaches to blended teacher CPD, but rather to discuss the available literature and emerging themes and point out where further research may be needed to improve our understanding. A systematic literature search was conducted and 30 articles, published between 2010 and 2021, constitute the final corpus of this review. The review analyses these studies using the model of effective professional development developed by Sims et al. (2021). This model identified four purposes of effective professional development (to instil insight, motivate the pursuit of goal-directed behaviour, develop new techniques and embed practice) and a set of 14 mechanisms addressing these four purposes (Table 1). The mechanisms presented in the included studies were mapped onto the mechanisms of effective CPD described in the model.

Table 1: The IGTP model and associated mechanisms (Sims et al., 2021)

Instil new insights (I)	• Manage cognitive load • Revisit prior learning
Translate these insights into goal-directed behaviours (G)	• Goal setting • Credible sources • Praise, reinforce
Help teachers to develop specific teaching strategies around research insights (T)	• Instruction • Practical social support • Modelling • Feedback • Rehearsal
Help teachers to embed evidence in their practice (P)	• Prompts/cues • Action planning • Self-monitoring • Context-specific repetition

Key findings

- The online aspect of blended learning should combine the sharing of new knowledge with opportunities for learners to interact with other participants as well as their facilitators around the course content.
- The principal barriers to effective blended CPD relate to:
  - a lack of access to digital technology
  - limited digital literacy
  - participant fatigue
  - a high dropout rate in the online part of blended learning.
- These barriers can be addressed by:
  - determining participants' access to digital learning technology and addressing any gaps
  - testing participants' digital skills at the start of the course
  - running follow-up learning activities for those with limited digital literacy
  - balancing interactive activities with face-to-face sessions.
- Various forms of blended CPD exist and the balance between online and face-to-face activities may vary in each of them:
  - combining an online learning platform with face-to-face sessions: online learning platforms can be used to share online learning modules and/or to store CPD materials (reading, videos, lectures etc) whilst face-to-face teaching is used for further support, application planning, reflection and discussion.
  - combining MOOCs with face-to-face sessions: MOOCs can be combined with local reflection sessions or study groups to discuss videos of classroom practice.
  - combining face-to-face with virtual sessions: virtual sessions may be supplemented with online reflective journaling, synchronous and asynchronous discussions.
  - combining blogs with interactive workshops: blogs may be used as a basis to share CPD content and allow teachers to interact with each other. Workshops can be used to support teachers in getting acquainted with the blog and its functionalities.
  - a model of 'flipped CPD': pre-recorded videos are used for instruction, which can be repeatedly watched by students' in their own time outside of the classroom. Time in class is instead used for reflection and discussion, enabling misconceptions to be addressed.
- A range of media can be used to support different aspects of blended CPD, including: videos, blogs and social media. Synchronous and asynchronous modes of communication can complement each other in blended learning environments. Designing high-quality blended learning environments requires careful consideration of the benefits and disadvantages of each interactive medium.

Instilling insights

Blended approaches to teacher CPD could be improved by incorporating principles from cognitive science so as to decrease cognitive load for participants and build on their prior knowledge.

Motivating goal-directed behaviours

The use of credible sources appears to be well-established in blended CPD programmes for teachers and allows for learning to be rooted in the best available evidence. However, explicit goal-setting and praise could be incorporated more widely in order to improve their effectiveness.

Developing techniques

Instruction was commonly incorporated into blended CPD programmes. This is perhaps unsurprising, given that the main aim of CPD is to teach practitioners about new approaches to teaching their subject and to change their practice as a result. Practical social support was also commonly included, through the development of a Community of Practice. Some of these communities of practice were online, with collaboration and peer support provided through synchronous or asynchronous online discussions. Feedback was only included as part of comments on assignments, inquiries or lesson plans but not as part of classroom observations. This emphasises an important limitation of the studies included here as it is unclear to what extent changes were actually implemented in the classroom. The mechanisms of modelling and rehearsal, especially the latter, could be used more widely in order to improve the effectiveness of blended CPD.

Embedding practice

Prompts, such as text messages or emails prompting teachers to implement changes in practice, were not included in any of the studies whilst action planning was included in the form of lesson planning. Reflection was relatively common but self-monitoring does not seem to be widely used. Only a handful of studies included an element of context-specific repetition but those that did suggest that a cyclical approach to implementation and reflection might be most beneficial.

Overall, this review highlights that blended approaches to teacher CPD can be effective, but that further research is needed to understand how features of effective CPD can be executed in a blended learning context.

Introduction

Teachers are the most important in-school factors for student achievement (Slater et al., 2012; Kane et al., 2013), and research has repeatedly shown that continuing professional development (CPD) can positively impact teacher effectiveness and, in turn, student learning although the size of the impact depends on the nature of the programme (e.g.: Fletcher-Wood & Zuccollo, 2020; Kennedy, 2016; Sims et al., 2021). Following the Covid-19 outbreak and resulting (partial) school closures and lockdowns, a lot of initial and continuous teacher training provision has moved online (e.g. La Valle et al., 2020; Rahayu & Suprina, 2021). What was initially born out of necessity (e.g. Noor et al., 2021) is starting to gain traction in the profession as teachers and providers are starting to embrace the added flexibility online and blended approaches provide (Müller and Goldenberg, 2020) while also looking forward to the possibility of meeting up face-to-face again.

Online and blended approaches have the potential to address existing inequalities in access to high-quality CPD for teachers in remote locations (e.g. Farmer and Childs, 2021) and those with caring commitments (OECD, 2019). They may also address some barriers that teachers with disabilities are facing when attending CPD (e.g. travel, non-accessible locations) although accessible design needs to be considered. Online approaches are also more cost-effective, learner-centred and self-paced, allowing for more flexibility (Zhang, 2004). On the other hand, face-to-face workshops can provide teachers with motivating networking opportunities, allowing them to cultivate a social community, enable immediate feedback and do not require digital literacy skills (Zhang, 2004).

When well designed, blended approaches can combine face-to-face and online learning opportunities in such a way that they utilise the benefits of each mode all while avoiding their disadvantages or challenges. However, when designed or executed inappropriately, negative properties can of course also be exacerbated.

This literature review adds to a recently published rapid review (Perry et al., 2021) on online and blended learning by including literature from outside the education sector as well as a wider range of studies that were not included in the rapid review, which focused mainly on online only approaches. At the same time, it takes a narrower approach by focusing exclusively on *blended* approaches to CPD, thereby excluding fully online approaches as well as initial teacher training (ITT).

As noted by Perry et al. (2021) literature in this field is disparate and of varying quality. The aim of this review therefore is not so much to draw final conclusions about effective approaches to blended teacher CPD but rather to discuss the available literature and emerging themes and point out where further research may be needed to improve our understanding.

This report first explores what is meant by CPD and blended learning before describing the different types of blended learning included in this research. Next, the report covers the technology used to support blended learning. The following section analyses which effective teacher CPD approaches are covered in the blended learning literature. Finally, more practical issues are considered.

1 | Continuing professional development (CPD)

What is CPD?

For the purpose of this review, we will be using the definition of CPD proposed by Sims et al. (2021) as "*structured, facilitated activity for teachers intended to increase their teaching ability,*" which excludes activities that are solely aimed at introducing teachers to a new programme or piece of technology as well as activities that are aimed at updating teachers about school business such as changes in safeguarding rules. This allows us to focus on programmes that are aimed specifically at improving teacher quality and are thus most likely to have an impact on student outcomes.

Sims et al. (2021) differentiate between CPD form, programme and mechanism. Form refers to the approach CPD takes (e.g. lesson study or journal clubs). A programme describes a specific suite of CPD activities and materials that tend to be associated with specific institutions or teams (e.g. dialogic teaching). Finally, mechanisms refer to the specific techniques that are used as part of CPD (e.g. repetition or critical reflection). In parallel to Sims et al. (2021), this review will be focusing on CPD forms and mechanisms and thus exclude specific programmes because such programmes often require financial resources or structural prerequisites that schools may not have access to and the aim of this review is to get a broader understanding that may be more widely applicable. We also propose to add a further category to the framework proposed by Sims and colleagues, namely 'mode'. 'Mode' here describes the medium through which CPD is delivered. This can be either fully face-to-face, fully online or partially face-to-face and partially online (i.e. blended or hybrid).

What is blended CPD?

In this review, the mode we will be focusing on is 'blended' teacher CPD', i.e. forms of CPD that combine face-to-face and online elements (Wong et al., 2014). This can also sometimes be referred to as 'hybrid', 'mixed mode' or 'technology-enhanced' learning (Wang et al., 2015). Unlike Allen et al. (2007), we apply a broad and inclusive definition of blended learning that does not postulate a specific ratio of online to face-to-face learning.

We follow the definition provided by Alammary et al. (2014, p.442) who describe blended learning as approaches that:

1. "thoughtfully integrate different instructional methods such as: lecture, discussion group, self-paced activity; and
2. contain both face-to-face and computer-mediated portions."

A growing body of literature highlights the potential of fully online courses (Manning et al., 2014) and social media (Visser et al., 2014; Wagner, 2018) for self-directed teacher development, but this review excludes online-only approaches of teacher CPD (e.g. MOOCs or Twitter) unless these were combined with face-to-face sessions or interactions. The same holds for CPD that takes place exclusively face-to-face. Furthermore, the focus is on the mode of the CPD itself rather than what it wants to convey. Therefore, CPD that focuses on increasing teacher's use of ICT but without taking a blended approach itself (e.g. Haßler et al., 2011) was not included.

We also exclude CPD that solely uses a 'synchronous blended/hybrid approach' (Raes, 2020) where some teachers participate in sessions face-to-face whilst others join the same sessions simultaneously online. Such approaches are excluded as they represent a very specific approach to blended learning that requires a range of technological equipment (e.g. tracking cameras, lapel microphones and additional screens), which are not necessarily easily available to a wide

range of schools (see Müller and Goldenberg 2021a for a discussion), making findings potentially less applicable across contexts.

What makes CPD effective?

This section is largely based on two reviews of effective approaches that were published very recently (Sims et al. 2021; Cirkony et al., 2021).

Sims et al. (2021) found that CPD which incorporated the four purposes of instilling insights (I), motivating goals (G), teaching techniques (T) and embedding practice (P) tends to be more effective. In their review, Sims et al. (2021) provide the example of helping teachers to understand the limits of working memory, supporting teachers to commit to a change in practice that is built on the understanding of working memory limitations, showing them specific strategies (e.g. not reading out text on a PowerPoint slide) and finally, using repetition to instil a long-term change in teachers' practice. The four purposes and associated mechanisms are outlined in Table 1.

CPD that only meets some of the purposes outlined above is likely to be less effective. For example, if it does not include elements which help teachers to embed the change in practice, teachers are likely to revert to old practice. If, in addition, CPD does not help teachers to develop strategies to implement research insights, they will likely experience a knowing-doing gap. Finally, if only theory is covered, a change in practice is unlikely to take place (Sims et al., 2021). Programmes that cover all four purposes are described by Sims et al. (2021) as 'balanced' programmes.

However, Sims et al. (2021) also stress that they did not aim to identify *"all possible or plausible mechanisms"* (p. 18) but rather focused on those mechanisms for which they could identify empirical causal evidence and of which they could find at least one example in the literature they reviewed.

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Sims et al. (2021) further define three forms of CPD that combine a series of these mechanisms and are clearly distinct from each other: lesson study, instructional coaching and teacher learning communities.

Cirkony et al.'s review (2021) took a broader approach to the definition of effective CPD. They largely come to similar conclusions as Sims et al. (2021) and highlight the importance of collaboration, active learning and reflection, content and pedagogy in context, coaching, external expertise, modelling as well as audience and alignment. These largely overlap with some of the mechanisms outlined by Sims et al. (2021) but Cirkony et al. further emphasise the importance of sustained duration and workplace conditions that are not described explicitly within Sims et al.'s (2021) model.

Although not described explicitly, sustained duration is somewhat implied by Sims et al.'s (2021) model in that it includes an element of supporting teachers to implement learning in practice as well as elements of repetition and as Cirkony et al. (2021) point out, it is not so much the sustained duration itself but rather the activities that take place during long-term programmes.

Regarding workplace conditions, Sims et al. (2021) categorise these as barriers or levers to effective implementation to CPD rather than a mechanism of the PD itself. The role of school leaders is vital in establishing a culture of collaboration and supporting staff development (Cordingley et al., 2015; García-Martínez et al., 2018; Timperley, 2007; Robinson et al., 2009; Robinson and Gray, 2019). They need to set challenging expectations, lead teaching, learning and the curriculum, establish an orderly environment that promotes learning, use resources strategically and align activities around key priorities and promote or model professional learning (Robinson et al., 2009). Senior leaders acting as lead learners (Cordingley et al., 2015) and instructional leadership (García-Martínez et al., 2018) can further positively impact CPD effectiveness. Leaders are also instrumental in removing some of the key barriers that prevent teachers from accessing CPD such as releasing teachers from their teaching duties to attend CPD (OECD, 2019). These strategies are key to establishing a supportive professional school environment, which positively impacts the development of teachers' self-efficacy and, in turn, student outcomes (Kraft and Papay, 2018). This overview highlights the importance of school leaders and school culture in facilitating CPD, but it also suggests that a conducive environment sits before or around rather than within CPD activities themselves.

In order to make changes following CPD, teachers need autonomy to make those changes. Autonomy can be enabled by leaders who remove barriers to teachers making informed decisions for their own settings or at the system-level where teacher professionalism is fostered. Despite the importance of autonomy, it is not mentioned explicitly by Sims et al. (2021) or Cirkony et al. (2021). The reason for this may be that results regarding the importance of autonomy are mixed, but it seems important to include a brief discussion.

Some research suggests that CPD may be more effective when teachers participate voluntarily (Kennedy, 2016; Mandaag et al., 2016), although this suggestion is questioned in some other reviews (Cordingley et al., 2015; Salas et al., 2012) and, of course, some CPD such as regular safeguarding, first aid or curriculum changes has to be compulsory to ensure safe and compliant schools. It is likely that the relationship between compulsory CPD and teachers' professional development needs also plays a role as compulsory CPD that is still perceived as relevant is more likely to be effective than CPD that is perceived as irrelevant to teachers' needs and their daily classroom practice.

2 | Blended learning

Effectiveness and benefits of blended learning

Research on effective approaches to distance learning indicates that effective teaching is largely independent of the modality it occurs in. In other words, what works in face-to-face teaching usually also works in online learning (EEF, 2020; Müller and Goldenberg 2021a; 2021b). This is not to say, of course, that there aren't specific aspects that need to be considered when teaching or providing CPD online (e.g. digital literacy and safety, facilitation of collaborative learning or technological approaches to assessment) but the main principles of effective CPD are also likely to apply to blended approaches.

Research comparing blended and face-to-face approaches to CPD also finds that blended approaches are at least as effective as in-person teaching (Sullivan, 2017; Zhang and Zhu, 2017; Wu et al., 2020). Some research even assigns additional benefits to blended learning over face-to-face teaching. Owston's (2018) review of the blended learning literature suggests that blended learning may facilitate learner empowerment, even more so than traditional face-to-face or fully online learning. This appears to be the case because it facilitates student choice but also provides them with the social interactions that are a key aspect of constructivist learning theories.

One affordance of blended learning is that of flexible access to online learning by students with caring responsibilities, which is also relevant in the context of teacher development (Owston, 2018; Szabo and Szinger, 2019). The additional flexibility provided by blended learning thus likely increases access and improves engagement with CPD for teachers from a wider range of backgrounds. However, in order for participants to fully benefit from this added flexibility, course designers need to carefully consider the ratio of synchronous to asynchronous activities (Owston, 2018).

Furthermore, evidence from Initial Teacher Training (ITT) suggests that blended approaches also facilitate international collaboration, opening up the potential to discuss similarities and differences between systems and to learn from teachers beyond a specific region (Orsini-Jones and Cerveró Carrascosa, 2019).

Using a Community of Inquiry framework

In addition to general features of effective CPD, the online part of blended learning needs to be designed carefully to create an effective learning experience. The Community of Inquiry framework (Garrison et al., 2000; Garrison et al., 2010; Swan et al., 2009) describes three intertwined 'presences' that are important to consider when designing online learning sequences. These are 'cognitive presence', 'teacher presence' and 'social presence' Despite ongoing research into the precise conceptualisation and operationalisation of the three 'presences' (Garrison et al., 2010; Dempsey et al., 2019), and some critique around its validity and the lack of focus on learning outcomes (Rourke and Kanuka, 2009, although see Akyol et al., 2009 for a response), the model has largely been recognised as a useful framework to describe online and blended learning environments and has been validated in a number of studies since its development (Carlon et al., 2012; Heilporn et al., 2020).

Cognitive presence describes a process of reflective inquiry (Swan et al., 2009) and consists of four phases: a triggering event, exploration, integration and resolution. Too often, learners do not move to the integration and resolution phases during online learning (Garrison et al., 2010). Social presence describes "*participants*

identifying with the community, communicating purposefully in a trusting environment, and developing interpersonal relationships" (Garrison et al. 2010). It consists of open communication, group cohesion and affect. It is important to stress the interconnectedness between social, teaching and cognitive presence. As outlined by Garrison et al. (2010), social presence in online learning does not exist in isolation of the other two presences. Participants are not there to interact socially but to interact meaningfully around a learning task and to develop their identity as a member of a learning community.

Finally, teaching presence consists of design, facilitation and direct instruction. It is considered to be an essential aspect of online teaching quality and has been found to correlate with student satisfaction (Bangert, 2008; Garrison et al., 2010). The original operationalisation of this concept was mainly concerned with the facilitation and responsiveness in threaded discussions (Anderson et al., 2001). However, technological advancements and changes in its definition have since been expanded (Shea et al., 2010). Shea et al. (2010) show that teacher presence also encompasses communication through comments on coursework and in folders or emails. Furthermore, the authors have added the category of assessment, both formative and summative, to the conceptualisation of teaching presence.

Göktürk Saglam and Dikilitas (2020) confirm previous research which found positive correlations between instructor teaching presence and student social presence within the context of an online course and provide a helpful illustration of the practical realisation of these three presences in an online course.

In sum, research in the field thus suggests that the online aspect of blended learning should combine the sharing of new knowledge with opportunities for learners to interact with other participants as well as their facilitators around the course content.

Whilst the blended and CPD literature more widely can provide us with important insights, the aim of this review is to consider how blended approaches have been applied to teacher CPD specifically.

Barriers to effective blended learning

The principal barriers to blended learning relate, of course, to a lack of access to digital technologies and the internet (Garbe and Louloudi, 2018). Evidence from CPD in teaching as well as other disciplines such as healthcare (e.g. Ngenzi et al., 2021) confirm that a stable internet connection and access to digital technologies are prerequisites for participants to engage meaningfully in blended learning and to avoid frustrations (Lane et al., 2016; Haßler et al., 2011). Facilitators may thus want to start their planning by finding out from participants how they are planning to access the online aspect of blended learning as this may impact which technologies best support their learning (e.g. some online learning platforms do not display well on smartphones). Thirumalai et al. (2019) found that the majority of their participants accessed the online learning part of their programme via smartphones rather than computers, which affected their choice of software and activities.

Moreover, although blended learning provides more flexibility, practitioners may still find it challenging to find the necessary time and space to engage with online learning at home (Lane et al., 2016). Another aspect that requires careful consideration when planning blended learning is that of participant fatigue (Ngenzi et al., 2021). However, time is not only an issue for participants. **Digital competency is another significant factor influencing the success of blended learning** (e.g. Karavas & Papadopoulou, 2014).

Whilst the digital literacy of teachers has undoubtedly increased as a result of distance learning due to Covid-19 (Müller and Goldenberg, 2020b; 2021b), it remains important to consider if learners need any support to be able to fully engage in the online aspect of online learning. For example, Thirumalai et al. (2019) found that over 50% of their participants required additional training in digital skills before they were able to fully access online learning. In this case, this issue was addressed by providing a foundation course in digital literacy at the start of the course. Facilitators could make such a module available on a voluntary basis, allowing participants to self-assess if they need it without overburdening those who feel that they do not require additional training.

Another barrier to the online aspect of blended learning is the high dropout rate of online CPD participants (Kim et al., 2011). There are a number of reasons why teachers may be less likely to complete online training than face-to-face CPD. Whilst the flexibility it affords can be an advantage, it also comes with limited accountability and no ring-fenced time for CPD. Kim et al. (2011) also found that sometimes online learning can take longer than face-to-face CPD due to the digital skills that are required to engage with it (see above). Or sometimes the design may lead to higher workload (Andre et al., 2021). Blended learning can also take longer to design and plan than face-to-face sessions, adding an additional burden to the workload of course designers and facilitators (Louloudi and Seidler, 2018). Insufficient functionality of certain e-learning platforms can further lead to increased workload and frustration on the side of course designers and participants (Louloudi and Seidler, 2018).

Finally, motivation can be negatively affected in online or blended programmes (Louloudi and Seidler, 2018), which is why it is important that facilitators clearly state the aims of their project, so that learners are aware of what to expect and can prepare adequately (Kim et al., 2011).

Key approaches to blended learning

Rather than moving from fully face-to-face straight into carefully planned blended learning, it is likely that instructors will go through a phase of trial and error where they tweak the specific activities they want to include as well as the balance between face-to-face and online learning. In their review of blended learning in higher education, Alammary et al. (2014) identify three design approaches that they call low-, mid- and high-impact, depending on the blend between online and face-to-face activities. Low-impact blended learning describes courses in which online activities are simply added to existing courses but without replacing any existing activities. Mid-impact blended courses replace some traditional face-to-face activities by online forms, and high-impact blended learning are those courses that are built as blended courses from scratch. In their article, Alammary et al. (2014) describe a number of benefits and challenges that each of these formats bring with them, which are briefly summarised on the following page. (Table 2).

This overview shows that blended learning can exist on multiple levels, ranging from the incorporation of a few online activities into existing courses to blended learning that is planned from scratch. It also shows how important it is to consider facilitators' previous experience with blended learning as this will likely impact how comfortable they feel using a range of different technologies and incorporating them with more traditional teaching. Furthermore, pedagogy must sit at the centre of any blended learning activity and the right blend is influenced by teachers' digital skills and attitudes, pedagogical goals and student attitudes and digital skills.

Table 2: Features of low-, mid- and high-impact blended courses (adapted from Alammary et al., 2014)

	Benefits	Challenges
Low-impact	• Easy and likely motivating for instructors who are hesitant towards blended learning • Quick in responding to specific pedagogical need • Low risk of failure • Limited experience required	• At least minimal digital literacy and digital pedagogy skills required to select appropriate tasks and support students • High risk of producing two separate courses rather than a blend • Can lead to extra workload for students • Potential issues around pay for extra activities (HE-specific)
Recommendations for low-impact blended courses	• Start with a single new online activity and evaluate it (e.g. online discussion board) • Additional activity should be driven by pedagogical goal • New activity must be well integrated into the course • Do not overload a course with additional online activities	
Mid-impact	• Start simply and increase incrementally • Build teacher confidence gradually • Well-suited for teachers with some yet limited experience with blended learning • Allows ongoing experimentation	• Requires good technological knowledge • Replacement and integration of new components requires time and effort • No standards as to which components should be replaced • Requires long-term planning and ongoing evaluation
Recommendations for mid-impact blended courses	• Apply the replacement approach step-by-step • The best balance will vary based on a range of factors, including student and teacher preferences, teaching style and instructional goals • Regular review and course evaluation is required • Best suited for teachers with some prior experience with blended approaches • Institutional support is required	
High-impact	• Opportunity to enhance existing courses and eliminate problems • Better integration of face-to-face and online activities due to integration from the start • Allows students to get maximum benefits of blended learning	• Requires advanced digital literacy and pedagogical skills and expertise in blended learning • Higher risk of failure due to complete novelty of course format • Teachers need to consider and understand wide range of activities and components • Takes substantially longer than developing a traditional course (2–3 times more) due to the development of online elements
Recommendations for high-impact blended courses	• Teachers with no or limited experience with blended learning may want to start with one of the other two approaches • Plan in sufficient time for the design • Consider including a variety of activities in your blend • Institutional support is key for success	

3 | Types of blended learning

As outlined in the introduction, we applied a broad definition of blended learning, not specifying the exact activities or the ratio of online and face-to-face learning that needed to be present in studies in order for them to be included. The presentation of results therefore commences by discussing the various forms of blended learning that were identified in included studies:

- Online learning platform/website + face-to-face sessions
- MOOC + face-to-face sessions
- Face-to-face + virtual sessions
- Blogs and interactive workshops
- Flipped teacher CPD

Online learning platform/website + face-to-face sessions

The most popular form of blended CPD in this review was the combination of online learning platforms and face-to-face teaching (Impedovo et al., 2019; Goos et al., 2020; Thorpe and Gordon, 2012; Ndlovu and Mostert, 2018; Hennessy et al., 2015; Belland et al., 2015; Walsh et al., 2010; Szabo & Singer, 2015; 2019; Kotadaki et al., 2016; Karavas & Papadopoulou, 2014; Calleja, 2021; Coburn, 2016; 2019; Yip, 2019; Lane et al., 2016). Usually, online learning platforms were used to share online learning modules and/or to store CPD materials (reading, videos, etc) whilst face-to-face teaching was utilised for further support, application planning, reflection and discussion. In some cases, these activities were complemented by (online) Communities of Practice, which will be discussed in more detail below. In some cases, programmes evolved over time and first used face-to-face lectures which were recorded and later made available online to rewatch and as input for following cohorts (Goos et al., 2020).

MOOC + face-to-face sessions

Three studies specifically described the combination of Massive Open Online Courses (MOOCs) and face-to-face sessions (King et al., 2016; Thirumalai, 2019; Hertz and Engelhardt, 2021). We differentiate here between online learning platforms and MOOCs as the MOOCs described in these studies usually were not designed specifically for a specific cohort of course participants but rather as an open online course that was subsequently utilised as part of a CPD programme and combined with face-to-face sessions. For example King et al. (2016) combined MOOCs with local reflection sessions to discuss videos of classroom practice. Hertz and Engelhardt (2021) discuss a similar approach where study groups were combined with MOOCs to embed discussions in school contexts but also to engage teachers in MOOCs and encourage them to complete the online learning. Thirumalai (2019) further added a communities of practice element.

Face-to-face + virtual sessions

Two studies in this review combined synchronous face-to-face and virtual sessions to support teacher learning. In their study of computer-assisted language learning (CALL) Nami et al. (2020) combined seven face-to-face and six virtual sessions. The sessions covered a range of tasks that introduced participants to different tools and asked them to apply them to their practice. Teachers also wrote reports and presented to the group. The online real-time sessions were held in the virtual classroom of an online learning management system.

Andre et al. (2021) took a similar approach by combining online and face-to-face sessions in

their case study of blended approaches to CPD for PE teachers. Donnelly (2010) also combined face-to-face and video-conferencing but also added online reflective journaling, synchronous and asynchronous discussions.

Blogs and interactive workshops

Khan (2015) was the only study in this review to use blogs as a basis to share CPD content and connect teachers. The blog contained lesson plans and allowed teachers to interact with each other. Workshops were run to support teachers in getting acquainted with the blog and its functionalities.

Flipped teacher CPD

Razak et al. (2016) investigated a specific form of teacher CPD: flipped learning. Flipped learning is discussed separately here as it is somewhat of a sub-form of blended learning. Like other blended programmes, it combines online and face-to-face learning but it focuses specifically on flipping teaching from a place where a large chunk of class time is used for instruction to a place where instruction takes place in students' own time outside the classroom via pre-recorded videos. Time in class is then used to reflect on and discuss what learners saw in the videos. Using pre-recorded content for instruction has the further advantage that students can watch or read about a subject repeatedly and then address misconceptions in class. (Razak et al., 2016) have developed a flipped CPD programme that comprises the following four stages:

- Remembering and understanding; face-to-face
- Applying and analysis; online
- Evaluation; face-to-face
- Creating; online

4| Using technology to support blended learning

Studies in this review used a range of different technologies to support the digital aspect of blended learning. These included Moodle or other online learning platforms, webinars and online conferencing software as well as social media communication channels such as WhatsApp or Telegram.

Videos

Videos have been used in some studies in this review to model classroom practice and facilitate discussions (e.g. King et al., 2016; Impedovo and Malik, 2019). The ability to watch videos in their own time and pause them to discuss means that they can be adapted to learners' needs more easily than live teaching. In some cases, the recording of lectures also allowed facilitators to reuse them at a later point, ultimately reducing staff time for delivery of the project.

Blogs

Blogs can provide teachers with space to share their learning and engage in critical and reflective thinking. In their review, Khan (2015) discusses how blogs as an asynchronous discussion tool can complement the synchronous and often fast-paced nature of social media such as Twitter or Facebook. Blogs provide teachers with more time to potentially engage more deeply with their reading and reflect more thoroughly on their response than synchronous chat tools. When planning blended learning, facilitators may thus want to consider how synchronous and asynchronous forms of communication can best complement each other to facilitate both responsivity and in-depth reflection.

Social media

Although not strictly related to 'blended' teacher CPD, it is worth noting the rise in research exploring the use of social media such as Twitter and Facebook as part of teacher development (e.g. Ekoç, 2020; Davis, 2015; Carpenter and Krutka, 2015; Visser et al., 2014; Sumuer et al., 2014; Nicholas et al., 2018). This research shows that social media can play an important role in connecting teachers to peers beyond their school or region, reflecting and exchanging on their practice, receiving support from others and creating a community. However, social media should not be considered a neutral space for interaction (Robson, 2016). The use of real names, for example, can hinder contributors in taking a critical stance out of fear that this may negatively impact their job prospects. The 'like' function on Twitter or Facebook further encourages interactional positivity as it is easy for users to add encouragement to a post. On the flipside, anonymity provides users with the opportunity to hide behind their screen names and can be associated with a higher prevalence for conflict and insults (Robson, 2016). Furthermore, social media can also lend itself to perpetuating and promoting dominant discourses to the detriment of critical voices that often find themselves silenced (Robson, 2016).

Despite these shortcomings, Ekoç (2020) suggests that social media could be incorporated into formal CPD activities, possibly as part of hybrid CPD activities. Whilst none of the papers in this review explored the use of social media in the context of blended learning, course designers and facilitators may want to consider how they could incorporate existing social media platforms and networks into their courses so as to build on some of the benefits they provide. Furthermore, the use of existing social media platforms and networks may increase the sustainability of blended programmes in the long-term as teachers could continue to engage with interested peers beyond the end of a specific programme.

Thirumalai et al. (2019) in their study of blended teacher CPD employed the social media platform Telegram as a basis for teachers to access course

materials via a Bot and to communicate with each other. To this end, subject-specific groups were created. In these groups, teachers posted daily about their questions and concerns regarding the CPD programme. However, it should be noted that engagement in the communities decreased after the end of the programme. When establishing Communities of Practice it thus appears important to plan for long-term sustainability.

Choosing which interactive medium to use

As outlined in the section above on using technology to support blended learning, designing high-quality blended learning environments requires careful consideration of the benefits and disadvantages of each medium. Furthermore, whilst interaction is important for blended learning environments, interaction alone does not automatically lead to effective blended learning. It is important to consider the pedagogical principles that underpin each form of communication first and foremost (Donnelly, 2010). Donnelly (2010) discusses the perceived advantages of a number of different communication approaches, which we have summarised and expanded below (Table 3). This table can be used to guide thinking around different communicative activities in blended learning and how they can best complement each other to support learning in a blended context.

Table 3: Advantages of different communication forms (adapted from Donnelly, 2010)

Technology	Purpose	Advantage
Videos	Review classroom practice Facilitate discussion	Flexibility of access Possibility to pause and rewind video Reduction of staff time if videos are reduced
Blogs	Space to share learning Engage critically in reflective thinking	Can complement more fast-paced/top-level discussions, e.g. on social media
Social media	Connecting teachers beyond schools or regions Creating a community	Engagement beyond teaching Fast-paced interaction
Podcasts	Alternative to written content	Easier for participants to engage with who may have literacy or attentional difficulties
Live chats	Brainstorming and social integration	Immediacy
Online reflective journals	More in-depth reflection on and application of learning	Develops learners' metacognitive skills

5 | Blended learning research and effective teacher CPD approaches

5. Blended learning research and effective teacher CPD approaches

In an attempt to bring together the existing literature on blended teacher CPD and effective approaches to CPD more widely, the mechanisms of studies on blended teacher CPD included in this review were mapped on the 14 mechanisms of effective CPD presented by Sims et al. (2021). Results of this analysis are presented in Table 4.

It is important to note that this analysis is limited to the information that was provided within each of the articles. The level of detail provided in each article differed vastly, ranging from in-depth accounts of programmes to brief overviews. It is thus possible that some of the programmes included additional mechanisms that were not described within the articles and are therefore not included in the analysis.

However, this overview does allow for some general conclusions about the field of blended teacher CPD, where programmes could be improved and where further research is needed. Only papers including details about specific CPD programmes or suites of activities were included in this analysis. Reviews were excluded.

Table 4: Mechanisms of blended approaches to teacher CPD mapped onto mechanisms of effective teacher CPD

	Instil insights (I)		Goal-directed behaviours (G)			Develop techniques (T)					Embed practice (P)			
Article	Manage CLT	Prior learning	Goal setting	Credible sources	Praise	Instruction	Social support	Modelling	Feedback	Rehearsal	Prompts	Action planning	Self-monitoring /Reflection	Context-specific repetition
King et al (2016)						X	X	X						
Goos et al. (2020)				X		X	X					X	X	
Impedovo & Malik (2019)						X	X	X				X		
Thorpe & Gordon (2012)				X		X	X	X	X					
Ndlovu & Mostert (2018)				X		X	X		X			X		
Hennessy et al. (2015)			X	X		X	X	X				X		X
Donnelly (2010)			X	X		X	X					X	X	
Thirumalai et al. (2019)				X		X	X					X	X	
Razak et al. (2016)		X		X		X	X	X					X	
Belland et al. (2015)			X			X	X	X				X		
Walsh et al. (2011)			X	X			X		X			X	X	
Khan (2017)				X		X	X							
Nami et al. (2020)						X	X							
Kotadaki et al. (2016)				X		X						X		
Lane et al. (2016)						X	X	X	X			X	X	
Karavas & Papadopoulou (2014)						X	X							
Andre et al. (2021)				X		X	X					X	X	
Calleja (2021)				X			X	X				X		
Yip (2019)				X				X				X	X	
Wu et al. (2020)				X		X	X	X						
Coburn (2019)				X		X	X					X	X	
Hertz & Engelhardt (2021)				X		X	X							
Ratkovich (2019)		X	X			X	X	X	X	X		X		X

Instilling insights

The first category of 'instilling insight' is concerned with how information is presented as part of CPD programmes. As is apparent in Table 3, not a single study in this review explicitly mentioned the manipulation of inputs with the aim of easing cognitive load for participants. It may well be the case that studies have presented information in smaller chunks or used diagrams to support learning, but this was not made explicit in descriptions.

Another way of using insights from cognitive science to shape teacher development is to build on teachers' prior knowledge. Two studies in this review (Razak et al., 2016; Ratkovich, 2019) explicitly asked teachers to reflect on their prior knowledge and/or uses of technology as a basis for shaping the programme. Ratkovich (2019) used surveys to explore teachers' prior experience with using assistive technology, and Razak et al. (2016) propose to start the flipped learning experience by a stage of self assistance in which teachers are encouraged to remember prior learning by responding to prompts and sharing learning autobiographies.

It is clear from this overview that blended approaches to teacher CPD could be improved by incorporating principles from cognitive science so as to decrease cognitive load for participants and build on their prior knowledge.

Motivating goal-directed behaviours

The second process described by Sims et al. (2019) is that of motivating goal-directed behaviour.

Praise

None of the studies in this review explicitly mentioned the inclusion of praise or reinforcement as part of the online learning programme. Sims et al. (2021) describe this mechanism as providing teachers with feedback on their practice and pointing out areas of strength. The aim of this mechanism is to motivate teachers to engage with the programme and thus differs from that of feedback on teachers' performance following the CPD programme, which will be discussed in the next section.

Goal-setting

Four studies in this review (Walsh et al., 2011; Belland et al., 2015; Donnelly, 2010; Hennessy et al., 2015) included some instances of goal-setting as part of their CPD activities. Walsh et al. (2011), for example, describe a model where action research is used to motivate goal-directed behaviours in teachers who plan actions based on research, trial them in their classroom and then discuss them with peers. This allows teachers to link past research to their specific contexts, thereby increasing their motivation to change behaviours.

Credible sources

Finally, the use of credible sources is described by Sims et al. (2021) as an approach to support teachers' motivation to formulate goals and implement change in their classroom. A large number of studies in this review (16) used credible sources as a basis for their CPD programme. Ratkovich (2019), for example, familiarised teachers with the principles of Universal Design as part of the CPD programme. Walsh et al.'s (2011) programme also requires the engagement with evidence. Thorpe and Gordon (2012), on the other hand, took a different approach and used examples of good practice as an approach to 'credible sources'. Andre et al. (2021) also found that teachers appreciated external input but highlighted the importance of combining such input with the possibility to contextualise information.

This overview shows that the use of credible sources appears to be well-established in blended CPD programmes for teachers but that explicit goal-setting and praise could be incorporated more widely in order to improve their effectiveness.

Developing techniques

Overall, the third of the principles described by Sims et al. (2021), developing techniques, was the most widely used strategy across all included studies. Within this category, instruction and social support were most commonly incorporated into blended CPD programmes.

Instruction

Given that the main aim of CPD is to teach practitioners about new approaches to teaching their subject and to change their practice as a result, it is not surprising that nearly all studies included an element of instruction. Notable exceptions are Calleja (2021) and Walsh et al. (2011). As mentioned above, Walsh et al. (2011) took an action research approach where teachers presented their insights to each other, which differs to contexts where instructors would present materials to teachers in written form or orally. Calleja (2021) took yet another approach and exposed teachers to the inquiry-based processes they wanted them to subsequently apply in the classroom themselves. Even though both approaches aim to develop teachers' understanding of specific concepts, they differ from the more direct instruction described by Sims et al. (2021).

It also seems important to consider the content of instruction. Most studies focused on developing teachers' pedagogical skills or their pedagogical content knowledge. However, some studies (e.g. Goos et al., 2020; Ndlovu and Mostert, 2018; Coburn, 2016) also included an element of subject knowledge development (i.e. maths or language skills).

Social support

The importance of interaction and collaboration has been well established for online as well as offline CPD. It thus is not surprising that elements of social interaction or Communities of Practice were included in a wide range of included studies. Social presence has been associated with increased learner motivation, improved learning, levels of satisfaction among learners and teachers and retention in online CPD. A range of studies have investigated the potential of online Communities of Practice for teacher CPD and generally found them to have a positive impact on learning outcomes for teachers (Bostancioglu, 2018). However, comparatively fewer studies have investigated the role of online learning communities within the context of blended teacher CPD.

Karavas & Papadopoulou (2014) captured the experience of 11 teachers who participated in the pilot phase of the 2gather online platform, which was part of a larger initiative to introduce English language teaching to primary schools in Greece. Although the analysis is only based on a small sample, it indicates the positive impact that online Communities of Practice can have on teacher learning and their sense of community. 91% felt that the platform broke down barriers of communication and that it gave them a sense of belonging. Teachers also felt that the platform and exchanges with peers helped them to develop their knowledge and understanding.

A number of studies in this review included elements of collaboration and peer support with the aim of establishing (online) communities of practice (Calleja, 2021; Donnelly, 2010; Thirumalai et al., 2019; Hennesy et al., 2015; Walsh et al., 2011; Khan, 2015) but their approaches differed. Thirumalai et al. (2019), for example, used mobile messaging services (Telegram) to create subject-based teacher communities.

Donnelly (2010), on the other hand, combines asynchronous discussions with synchronous chat sessions and video conferencing sessions and differentiates between interaction as transaction and interaction as outcome. That is, communication can serve the purpose of creating, sharing or critiquing ideas but also of organising teams, for negotiation or to share ideas, possibly with the aim to convince others.

Walsh et al. (2011) combined online and face-to-face group interactions. During online 'teach shares', one 15-minute presentation was followed by discussion. During face-to-face teach meetings, on the other hand, multiple teachers presented practical insights and reflections for 2–7 minutes.

Ratkovich (2019) also combined face-to-face and online discussions. In their cyclical approach to blended teacher CPD, they brought teachers together to reflect on their use of assistive technology and to plan further implementation. This was followed by another modelling and feedback session, further implementation and an online discussion forum where teachers could share reflections and ideas.

Finally, Khan (2015) used yet another approach and employed blogs to facilitate discussions online. This provided teachers with the opportunity to base their discussion around shared reading and the asynchronous nature allowed them to reflect on their responses before sharing them.

Modelling

Modelling was used slightly less across studies than instruction or social support but was still relatively common. Eleven studies in this review included an element of modelling in their programmes. As discussed above, the principle of Calleja's (2021) CPD programme was for teachers to experience inquiry-based teaching methods so they could subsequently apply them in their contexts. They were thus exposed to models of inquiry-based learning as part of their CPD experience.

For example, King et al. (2018), Thorpe and Gordon (2012) and Hennessy et al. (2015) used videos as part of their online learning courses instead. Impedovo and Malik (2019) took a slightly different approach and had teachers share videos of their own practice with each other and reflect on them together, thus combining modelling (where good practice was shared) with an element of community of practice.

This highlights the advantage of blended learning approaches in which recordings of best practice can be used as a source of modelling and basis for discussion.

Feedback

Sims et al. (2021) define feedback in their model as the *"outcome of performance of the behaviour"* (p. 182) and listed examples all relate to instances where teachers are provided with feedback on their implementation of new practice as part of classroom observations, either live or using recordings. No studies in this review included live or recorded lesson observations. When feedback was provided, it was provided on reflection tasks (Thorpe and Gordon, 2012), inquiries and assignments (Ndlovu and Mostert, 2018), presentations (Walsh et al., 2011) or lesson plans (Ratkovich, 2019). Ratkovich's study took a cyclical approach with implementation at its core but feedback was not provided on classroom performance itself but rather lesson plans and teachers' reflections. While such instances of feedback are important, they are not comments on actual classroom performance. Programmes could be improved by including the possibility to trial new methods in a classroom setting and feedback from peers or facilitators.

Rehearsal

Only one single study used rehearsal as part of their CPD programme. Through their cyclical approach to CPD, Ratkovich (2019) provided teachers with the opportunity to implement the use of assistive technology repeatedly in their classrooms. Each cycle was accompanied by a community element and/or feedback from course instructors, providing teachers with ample opportunity to amend their classroom practice based on the comments they received.

Approaches to supporting teachers to develop new techniques were well implemented overall. However, the mechanisms of modelling and rehearsal, especially the latter, could be used more widely in order to improve the effectiveness of blended CPD.

Embedding practice

The final element discussed by Sims et al. (2021) is concerned with helping teachers to embed change in their practice.

Prompts

Prompts are described by Sims et al. (2021) as environmental or social stimuli to prompt a certain behaviour such as, for example, text messages or emails that would remind teachers to use a specific strategy in their context. None of the studies included in this review included prompts as defined by Sims et al. (2021). The only prompts that were discussed related to questions to guide teacher reflections.

Action planning

Action planning typically took the shape of developing lesson plans in studies included in this review (e.g. Ratkovich, 2019; Goos et al., 2020; Impedovo and Malik, 2019). Teachers learned about new teaching strategies or technologies and were then encouraged to include them as part of their usual lesson planning. These lesson plans could be developed individually or as a group.

Self-monitoring/reflection

Self-monitoring as defined by Sims et al. (2021), i.e. the monitoring and recording of actions as part of behaviour change strategies, was not part of any study in this review. Reflection, however, was embedded in many of the included programmes. As it was included as part of behaviour change models and not just for data analysis purposes, studies that included an element of reflection were included in the analysis. Yip (2019) represents a strong example of using reflective practice as part of blended teacher CPD. They asked teachers to keep reflective journals and learning commentaries, which were subsequently shared with peers and discussed. This goes beyond some of the more light-touch approaches that included one-off reflection sessions without necessarily asking teachers to keep an ongoing journal.

Context-specific repetition

Only a few studies in this review included an element of classroom implementation which also formed part of the analysis. One such study, Hennessy et al. (2015) found that their programme had increased teachers' motivation to use interactive teaching strategies, which had also improved student outcomes. In Ratkovich's (2019) study, implementation formed a core part of the cyclical approach to teacher development which included multiple instances of implementation, reflection and discussion. Another example is Coburn's (2016; 2019) study of primary school teachers' English as a foreign language teaching skills. Coburn used self-report to measure changes in practice and also found a positive impact.

6 | Putting CPD into practice

Teachers' experiences of blended CPD

Multiple studies found that teachers' attitudes and experiences with blended learning tend to be positive (Thirumalai et al., 2019; Khan, 2017; Lan et al., 2016; Andre et al., 2021). However, the findings also highlight the importance of ensuring that training is relevant to teachers' interests and teaching priorities (Thirumalai et al., 2019). Lane et al. (2016) also found that teachers were relatively satisfied with their blended CPD programme and that satisfaction increased over the course of the two-year programme. By the end of the programme, 52.5% of participants indicated that they were satisfied with the programme. Technological difficulties tend to be the biggest challenge in blended learning programmes. Kotadaki et al. (2016) further found that programmes that try to cover too much in too little time can be frustrating for teachers. The participants indicated being dissatisfied by the fact that they did not have enough time to try out all the tools discussed in the programme.

Importance of protected time

Before teachers can engage in any CPD, barriers need to be removed. A lack of time and conflicting work schedules tend to be the number one barrier to engaging in CPD (OECD, 2018), and this is possibly exacerbated for more experienced teachers and women (Müller et al., 2021; Booth et al., 2021). It is therefore important that CPD can be arranged around teachers' work schedules and personal lives or that teachers are released from teaching duties to attend CPD. In the latter case, organising teacher cover is important. Digital approaches to CPD, such as online courses, webinars or online journal clubs, may provide more flexibility than traditional forms of CPD. The possibility to choose online training based on relevance rather than proximity is a further benefit and so is ease of access for teachers with disabilities. The increased use of digital tools in teacher education would also democratise access to high-quality CPD by allowing teachers from across the world to engage in a wider range of activities that would otherwise not be available to them and enable international dialogue to share best practice.

The lack of incentives is another common barrier to CPD engagement (OECD, 2019). CPD may be more effective when it is explicitly linked to career progression, which is the case, for example, in Lithuania where teachers need to complete CPD as part of retention and progression processes (OECD, 2019). Research also suggests that this link between CPD and career progression may be of particular relevance in developing countries (Popova et al., 2018). However, the multi-faceted nature of career progression, which may not necessarily mean a move into leadership positions, needs to be considered, as teachers may want to develop further as classroom practitioners instead and CPD offers should provide this possibility (Booth et al., 2021).

A number of studies in this review also highlighted the importance of time for teachers to complete blended CPD. Thirdumalai et al. (2019) and Hertz and Engelhardt (2021) found that it is important for teachers to have ring-fenced time to participate in CPD. This is further confirmed by Coburn (2016b), who highlighted the importance of paid study leave for teachers to fully participate in their CPD activities. When planning blended CPD, facilitators should thus consider:

- Taking a long-term approach
- Harmonising blended and face-to-face learning.

Taking a long-term approach

The benefits of long-term approaches to CPD have been well documented in the literature. Studies on blended CPD further confirm these findings. For example, Coburn (2016a) found that the long-term orientation of the blended CPD

approach for primary English language teachers studied in their project, allowed for a better integration of both theory and practice and thus contributed to the overall positive outcomes of the programme.

Harmonising blended and face-to-face learning

In addition to the features of effective CPD that should also be considered when designing blended approaches, Donnelly (2010) highlights the importance of harmonisation between face-to-face and online learning. This means that instructors need to be explicit to students about what is expected of them in each of the modes and consider carefully the specificities of each mode so as to make the most of each of them. In other words, blended learning is not just about online learning on the one hand and face-to-face teaching on the other, but rather about the combination of the two. Consideration thus needs to be given how they can best be combined so as to use the advantages and avoid the disadvantages of both. In practice, this can for example concern the choice of medium for communication. Some of the data presented by Donnelly (2010) suggests that face-to-face communication may lend itself better to more extensive and in-depth communication that is more difficult to convey in written form. Depending on the learning activity, facilitators may thus prefer one medium over the other.

Conclusion

This review shows that blended approaches to teacher CPD are gaining traction across the world and have great potential to increase the reach and impact of such programmes. At the same time, it also highlights the heterogeneity of studies in the field of blended teacher CPD, the lack of large-scale studies investigating its effectiveness and the need for blended programmes to be designed with features of effective CPD in mind. In particular, randomised controlled trials assessing the effectiveness of different approaches to CPD (e.g. online learning platforms + face-to-face interactions vs. flipped approaches or virtual and face-to-face sessions) or comparing blended and fully online or face-to-face CPD are missing from the field.

Furthermore, current studies have mainly focused on English teaching as well as maths and the sciences. Studies investigating blended approaches to teacher CPD in the arts and humanities are largely missing. In order to draw more concrete conclusions around the most effective approaches and mechanisms in blended teacher CPD, the focus should be expanded in future studies. This seems especially relevant in the context of arts teaching, where CPD often aims at developing teachers' self-efficacy in handling different materials and developing their own competence around a range of different art forms. It seems important to consider how such 'hands-on' activities can be applied to the online environment and which constraints need to be overcome when doing so.

Barriers to blended learning that were identified in this review include first and foremost access to a stable internet connection and suitable devices. It was shown that in some studies, the majority of teachers accessed online learning via their smartphones, which significantly impacted their ability to engage with the online learning element of the blended learning programme. It thus appears advisable for programme developers and facilitators to start their initiatives by finding out from participants how they plan to access online learning as this will significantly impact the choice of activities and ratio of online to face-to-face teaching. As part of such an initial assessment, developers or facilitators could also include an assessment of participants' prior experiences with blended learning and their digital skills and provide additional training in the latter if needed so as to avoid frustration at a later point during the programme. This could further help with the higher dropout rates that were discussed and the lack of motivation sometimes observed in online or blended programmes. By clearly communicating expectations and aims and addressing any potential barriers at the start of the programme, facilitators are more likely to avoid demotivation and resulting dropout later on. An induction phase should thus form an important part of any blended learning programme.

When designing blended learning programmes, facilitators may also want to consider the classification into low-, mid- and high-impact programmes that was presented in this review. A gradual move from low- to high-impact programmes may be more advisable for programmes that are already in place rather than an abrupt move to high-impact programmes. Furthermore, it should be noted that high-impact programmes require a high level of digital skills in facilitators and preferably some experience with blended learning programmes or additional guidance for participants. Table 2 can help guide decisions around the level of blended learning that providers want to develop.

This review also showed that blended learning programmes that combined an online learning platform with face-to-face interactions tend to be the most popular. Platforms are most commonly used to store materials and sometimes to facilitate discussions, whilst face-to-face interactions are used for workshops and joint reflection. The combination of MOOCs and face-to-face meetings was also discussed and provides

the opportunity to use existing materials with contextualised discussions. The advantage of this approach is that existing materials can be used, which significantly reduces the cost of blended learning programmes when compared to fully newly designed programmes whilst also providing a more personalised discussion of the learning material. Other approaches to blended learning discussed in this review include the combination of face-to-face and virtual discussions, mainly with the aim to increase reach as well as a combination of blogs and workshops where blogs were used as an approach to reflect on practice. Flipped CPD was also discussed as a sub-form of the combination of face-to-face sessions and online workshops as it focuses specifically on teachers engaging with materials prior to CPD sessions and subsequently discussing them. It would be interesting to compare these various approaches to determine which of them lend themselves best to developing teacher practice across different subject areas.

This review mapped the mechanisms presented in the included studies onto the mechanisms of effective CPD described in Sims et al. (2021). This analysis highlighted that blended teacher CPD programmes could be improved by focusing more specifically on accounting for CLT and activating participants' prior learning. By utilising teaching approaches that have been found to be effective, CPD can be improved further. Supporting participants to reflect on prior experiences with a particular approach allows them to activate prior learning and contextualise what they learn in the blended programme. In terms of goal-setting behaviour, blended approaches to teacher CPD could be improved further by including elements of praise and specifically defining goals. Only a few studies in this review included such elements. The inclusion of credible sources, on the other hand, is widespread and allows for learning to be rooted in the best available evidence.

Finally, mechanisms of implementation were also represented to a varying extent across studies. Prompts as described by Sims et al. (2021), i.e. text messages or emails prompting teachers to implement changes in practice, were not included in any of the studies, so future projects may want to consider how prompts could be included to encourage changes in practice. Here, a blended approach may be particularly beneficial as it allows course leaders to send prompts via email or social messaging services or programming pop-up reminders in online learning platforms.

Action planning was included in some studies in the form of lesson planning, which took place jointly or individually. The advantage of including lesson planning as part of blended learning activities is that this gives teachers a concrete opportunity to implement changes in practice and connect learning to their specific contexts. Participants may benefit additionally from focusing on planning actions that will allow them to implement changes in practice. What do they need to change or stop doing in order to implement a change in practice?

Reflection was relatively well established across the different blended learning programmes, but self-monitoring as defined by Sims et al. (2021) does not seem to be widely used. This includes the monitoring of actions as part of behaviour change strategies and could be combined with the planning element described above. By focusing specifically on behaviour change and concrete actions, changes in practice may become more tangible for teachers and thus less overwhelming. The constant, long-term monitoring also allows teachers to avoid reverting back to old practices. Finally, only a handful of studies included an element of implementation, but those that did provide some interesting examples. For example, a cyclical approach to implementation and reflection allows teachers to combine the element of repetition and classroom implementation and instils the understanding that change requires a longitudinal approach.

Overall, this review thus indicates that blended approaches to CPD have great potential but that more studies comparing different approaches as

well as comparing blended and fully face-to-face or online approaches are needed. Furthermore, blended approaches may benefit from closer alignment with mechanisms of effective CPD. Finally, the existing research literature does not allow for conclusions about best practice in teaching hands-on-skills such as, for example, artistic techniques in a blended learning environment, which will need to be explored in further projects.

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Appendices

Glossary

Asynchronous: communication that does not occur in real time, such as emails or forums.

Cognitive load: the amount of information that working memory can hold at one time. Overloading the working memory can have a negative impact on learning. Information should be presented so as to not overload working memory.

Community of Inquiry: a theoretical framework that highlights social presence, teaching presence, and cognitive presence as essential elements to facilitate successful educational experiences in online distance learning environments.

Community of Practice: a group of practitioners who participate in a joint professional development process. A CoP may be distinguished from simply an 'online community' through its specific focus on learning.

Mechanisms: empirically-evidenced general principles about how people learn and change their practice. These are the core building blocks of a programme that, if removed, would make the professional development less effective.

MOOC: Massive Open Online Course. An open access course with unlimited participation accessed via the internet.

Purpose: effective CPD has four purposes: instil insight, motivate the pursuit of goal-directed behaviour, develop new techniques and embed practice.

Synchronous: communication that occurs in real time.

Universal Design: an approach to the design of environments, products and services to be usable by the widest range of people.

Methodology

Review protocol

The following search terms were developed by the research team based on their past work on online and blended approaches to teaching (Müller and Goldenberg 2021 a;b) and conversations with researchers in the field as well as the funders of this research. They were then entered into Google scholar and EBSCO in mid-November 2021 to determine whether the resulting list of articles appeared exhaustive.

effective

AND blended OR hybrid

AND CPD OR CPL OR continu* OR in-service

AND development OR training OR learning

AND teacher OR practitioner

A top-level analysis of resulting hits showed that many studies employed blended approaches that did not include an online element (e.g. Calleja, 2018), which was the main focus of this review. Therefore the term 'online' was included in the final search, which was conducted at the end of November 2021.

The terms teacher and practitioner were included to reflect the broader approach this review took to including literature beyond education.

The date range was set to 2010-2021 so as to focus on most recent studies. Whilst blended approaches to teacher CPD and initial teacher training have been around for longer (Perry et al., 2021), technology has moved on a lot since initial approaches that made use of radio technology. Given that the aim of this review was to present findings that could be used to inform future blended teacher CPD approaches, it was felt that studies using more outdated technology were less relevant and thus the date range was reduced.

The following inclusion and exclusion criteria were applied to the original corpus of 1,000 articles (Table 5):

Table 5: Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Article type	Peer-reviewed articles and grey literature (e.g. reports, PhD theses)	Blog posts, non-academic literature
Publication date	2010-2021	Published before 2010
Participants	Teachers, employees	Children, students
Mode	blended/hybrid approaches	Fully online/ face-to-face
Training	Continuous/in-service	Initial

Following title screening of all articles, 266 articles were taken through to abstract screening and 30 articles were included in the final review.

Articles were excluded for the following reasons:

- No full text available (even after contacting author)
- Not blended learning (ie either face-to-face or online only)
- ITT not CPD
- Not CPD but blended learning in another context
- Not academic publication
- Conceptual papers

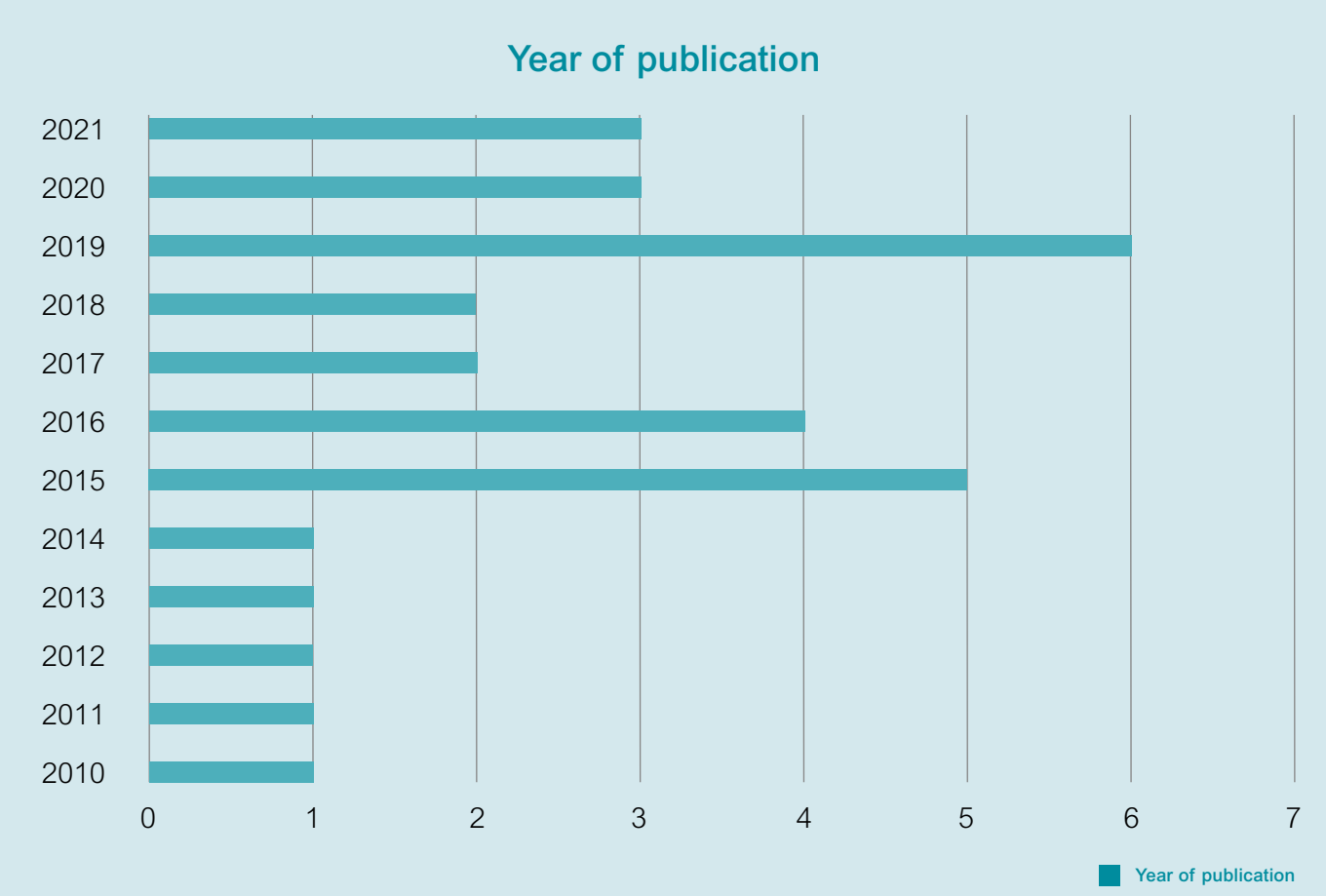
Data on publication type, country and subject focus was extracted.

Sample description

Description of study characteristics

A total of 30 studies form the final sample of this review. Two of these studies (Keengwe & Kang, 2013; Khan, 2015) are reviews whilst the remaining studies are empirical studies investigating different approaches to blended learning. The publications were spread across the 11-year timeframe that was specified for this review with peaks in 2019 and 2015 (Figure 2). It is likely that most recent developments following the COVID-19 are not yet included in this review due to the length of time it takes for articles to get through peer review stages.

Figure 1: Year of publication



Sample sizes

Most studies in this review had small sample sizes, ranging from just a single case to a maximum of 150 participants. In some cases, the final number of participants is not entirely clear. For example Thirumalai et al. (2019) say that the programme they analysed was taken by over 2000 teachers but it is not clear how many of them are part of the final sample. This clearly indicates that more robust studies are needed to be able to draw conclusions about the effectiveness of different blended models. Additionally, only one study compared blended learning to other models whilst the remaining studies only investigated one particular approach. This lack of control groups makes it difficult to draw any solid conclusions or make strong recommendations.

Geographical spread

The studies included in this review spanned a wide range of geographical contexts. The majority of studies were cross-European projects combining a combination of different countries, which included (Germany, Hungary, Romania, Belgium, Portugal and additional unspecified countries). Two of the three Irish studies investigated the same CPD programme, a 2-year PD programme for out-of-service mathematics teachers (PDMT). Table 6 shows the geographical spread of studies included in this review.

The disparity of locations highlights that interest in blended approaches to teacher CPD is growing internationally. This is likely due to the fact that blended teacher CPD is more easily accessible for teachers in remote locations but access to digital devices, digital literacy and stable internet connections remain barriers to effective CPD. The heterogeneity of contexts also means that conclusions need to be drawn carefully as education systems and teacher education vary vastly across countries.

Table 6: Geographical spread of studies

Region/Country	Number of studies in review
Asia	
Timor	1
India	3
Malaysia	1
Pakistan/Bangladesh	1
Singapore	1
Hong Kong	1
Europe	
Ireland	3
England	1
Greece	2
Malta	1
Norway	2
UK (unspecified)	1
multiple	4
Africa	
South Africa	1
Zambia	1
USA	3
Middle East	
Iran	1

Subject spread

The majority of studies in this review focused on developing teachers' competence in English (as a foreign language) teaching (Table 7). These courses usually combined the development of teachers' subject knowledge as well as their pedagogical content knowledge. Four studies focused specifically on the CPD of Maths teachers with two of them focusing on out-of-field mathematics teachers, i.e. those teachers without a formal qualification in mathematics. Again, these courses combined a focus on teachers' subjects as well as their pedagogical content knowledge. In one study, mathematics and science teaching were combined whilst another focused on science teaching only. The list of subject specialisms provided in Table 7 highlights the complete lack of studies focusing on the arts and humanities (e.g. Arts, Music, D&T, Dance, Geography, History, RE, etc). Four of the included studies stem from fields outside education and cover healthcare, nursing, social work and an HE teaching qualification across a range of disciplines.

Table 7: Spread of subject focus

Subject specialism	Number of studies
English language teaching	7
Maths	4
Subject-specific literacy	2
English, mathematics and science	1
Science	1
Using ICT in education	6
Digital storytelling	1
PE	1
Teacher educators	1
Reviews	2
Not subject-specific	3

Studies aiming to improve teachers' use of technology

Six studies focused on improving teachers' use of blended approaches and/or the use of ICT in their lessons (Thirumalai et al., 2019; Walsh et al., 2011; Khan, 2017; Nami et al., 2020; Yip, 2019; Ratkovich, 2019), while also using blended approaches to teacher CPD. Teachers were thus provided with the opportunity to experience the use of ICT first-hand whilst also developing their understanding of how to integrate technology most effectively into their classrooms. Ratkovich (2019) focused specifically on developing teachers' competence in using assistive technology to support students' learning.

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