Remote and Blended Teacher Education

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Definition

Remote teacher education is any mode other than face-to-face education, typically but not necessarily conducted online (i.e., using computers, tablet devices, smart phones and other web-based technologies). Blended teacher education is a combination of face-to-face and remote education in any proportion.

1. Introduction

It is widely acknowledged that teacher 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) [1][2]. Teacher education, including initial education and continuing professional development (CPD), is therefore arguably the most direct, effective, and cost-effective approach to school improvement (Fletcher-Wood and Zuccollo, 2020) [3]. Here, we define initial teacher education as any training provided to pre-service teachers as part of qualification; we define continuing professional development as any support or training for in-service teachers. In both cases our focus is on efforts to improve teacher effectiveness. We know it is possible to improve teacher effectiveness (Kraft and Papay, 2014; Hill et al., 2020) [4][5], and that there are also wider benefits of doing so including greater collective teacher efficacy (Tschannen-Moran and Hoy, 2001) [6], wellbeing, retention and recruitment, in particular for early-career teachers (Fletcher-Wood and Zuccollo, 2020; Cordingley et al., 2019) [3][7].

There is a long history of using blended learning for teacher education, in particular in developing and developed countries (e.g., see Burns, 2011, discussing initial teacher education) [8] and in locations where face-to-face provision presents challenges. In such cases, wireless education for teachers is a venerable forerunner of remote and blended CPD. Australia, for example, has a particularly long history of trying to meet CPD and teacher education needs remotely because of its topography.

2. Remote and Blended Teacher Education Modes and Their Characteristics

2.1. A Working Framework of Remote and Blended Teacher Education Modes

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

- Lectures, workshops, seminars, discussion groups or conferences, including one-off sessions and series.

- Coaching and mentoring.

- Classroom observations with feedback and/or discussion.

- Resource bases or repositories, with varying degrees of user interaction and content creation.

- Platforms and self-study programs, ranging from less to more structured programs that give access to curated/designed resources, learning content, assessments and/or directed activities to learners.

- Virtual reality spaces or simulations.

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

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

- (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.

- 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.

- 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) [9] have PLCs as a mode in their own right. In our view, 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).

- Choice of (Multi-)media—In remote and online teacher education program 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.

- 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'.

- Structure, design and facilitation—Programs 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 organizational 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.

- Providers/Partnerships—One other consideration is about the provider(s). Many teacher education programs were delivered and/or designed by a combination of one or more teacher groups, schools, universities, and/or local/national authorities working in partnership.

- 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. 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 conceptualize remote and blended teacher education so as to bring key teacher education or practical considerations into focus. One pertinent aspect that might be fruitful to examine in future is the availability of and resources for the technology involved. Resources, expertise and infrastructure for high-, medium- and low-tech approaches are likely to be key factors for applicability of this framework and the findings of this review across contexts. 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) [10]. We compared our framework 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.

Little and Housand (2011) (as Quoted in Elliot, 2017, p. 120–121) [9][11]	Snell et al. (2019) p. 210 [12]	Horn and Staker, 2011 (as Quoted in Burns, 2011, p. 70) [8][13]
- Mode 1—The first mode of online professional development is accessible websites or online resources. - Mode 2—The second mode of online professional development is technology for face-to-face interaction with audiences in real time. - Mode 3—The third mode of online professional development is professional development supported by asynchronous online discussion. - Mode 4—The fourth mode of online professional development delivery is videoconferencing. - Mode 5—The fifth mode of professional development is constructing and facilitating an ongoing online community.	(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. (2) Remote live coaching consists of coaches observing and providing feedback to teachers live, using webcams. (3) Online course content allows teachers to access online materials and read about [curriculum content], watch videos, and take quizzes. (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. (5) Online downloadable curriculum or lesson plans consist of resources available online for teachers to use in the classroom.	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. 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. 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. 4. Online Lab Model: The online teacher delivers the course in a brick-and-mortar classroom, but with paraprofessional or teacher aides supervising students. 5. Self-blend Model: Individual students take online courses à la carte. Online learning is remote, but traditional instruction is brick-and-mortar. 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.

2.2. Selected Examples and Illustrations

3.2.1. 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 teachers and other teachers, pre-service teachers, instructors, experts, stakeholders, or a combination of these. 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 programs (see mode 5); second, conferences, which typically combine numerous elements of which only some 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 discussed below); 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.

Varying interactivity and structure within conferences is one theme discussed in Seddon et al. (2012) [14], who present a model of web conference activity over the course of the conference in terms of their level of social interaction, information provision, internalization 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 is found in Burns (2011) [8]. Burns (2011) [8] particularly noted that the medium gave access to learning experiences that geographically distant teachers might not otherwise be able to participate in, while also reducing misunderstandings caused by the lack of non-verbal cues that may characterize other forms of online learning. However, there remain issues such as audio-visual quality, time lags, drops in service, coordination of activities and suitability of activities for the medium (Burns, 2011) [8]. We note the date (2011, discussing a Canadian network operating in 2001–2002) and the discussion of technological as well as teaching and learning considerations. Finally, Burns (2011) [8] noted that the instructor may not be able to see all the participants and that working with simultaneous face-to-face and remote groups might mean that one group was prioritized over the other.

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.

3.2.2. 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) [15], although practice and quality varies considerably (Hill et al., 2020) [5]. The National Framework for Mentoring and Coaching (CUREE, 2005) [16] 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 Fletcher and Mullen, 2012) [17][18]. 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.

3.2.3. 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 categorized classroom observation as a mode in its own right.

The literature on the use of classroom video for professional learning is summarized and discussed in Perry et al. (2020) [19]; a short summary of selected points from this is provided below, along with an example. Perry et al. provide an overview of potential 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) [20][21][22]:

- It captures classroom interactions for review outside of the classroom (Brouwer, Besselink, & Oosterheert, 2017; Pehmer, Gröschner, & Seidel, 2015; Tripp & Rich, 2012) [23][24][25].

- It can foster collaborative approaches to professional development: making it possible for joint learning between colleagues and/or external experts (Brouwer et al., 2017) [23].

- It may assist teachers to recognize previously unnoticed issues, allowing conceptions to change (Gaudin & Chaliès, 2015) [21]; a feature recognised by the 'Lesson Study' (e.g., Lewis, Perry, & Murata, 2006) [26] and 'Learning Study' (Davies & Dunnill, 2008; Holmqvist, 2010) [27][28] literature.

- It can offer convenient opportunities outside the school day for observations and discussions with teachers and their colleagues, reducing supply cover costs (Quinn et al., 2019) [29].

- It is efficient, in that the most instructive videos can be viewed repeatedly by a wider audience.

- The use of video platforms can support processes of teacher reflection, discussion and analysis through tools for editing or annotation (Rich & Hannafin, 2009) [30].

Running through these points one can see the connection with: external expertise and perspectives; discussion groups; enquiry and action research approaches; and platforms—hence why 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': viewing of the work of others can make teachers more receptive to new ideas and more engaged in the analysis of difficult incidents (e.g., Van Es, 2012; Borko et al. 2008; Kleinknecht and Schneider, 2013) [31][32][33], but this appears to be especially effective when viewing videos of others is preceded by teachers reviewing their own teaching (e.g., Beisiegel et al., 2017; Seidel, Stürmer, Blomberg, Kobarg, & Schwindt, 2011)

[34][35]—it seems it is the connection that counts.

One example in this area is Jamil and Hamre (2018) [36] in their study of online professional development on principles of learning from cognitive science. The programme takes a structured approach to teacher reflection asking teachers to observe, analyze, 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 find that the approach can enable teachers to examine objectively the consequences of their actions by distancing them from the immediate, emotional reactions to the situations (Jamil & Hamre, 2018) [36].

In overview, videos of classroom teaching provide teachers with 'objects to think with' (Jamil & Hamre, 2018, p. 74) [36], 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.

3.2.4. 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. Should providing access to a resource base even qualify in its own right as a form of teacher education? We are left wondering whether resources bases are better thought of as being content or curricula for teacher education rather than types of it, though 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) [5]. This question aside, there are numerous examples of resources bases that—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 emphasizes 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 resource bases that include classroom videos, such as those investigated in Bates, Phalen and Moran (2016) [37], 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) [38], 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.

3.2.5. Mode 5—Platforms and Self-Study Programmes

Many programs we have reviewed are based around an online 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 organizational focal point for a PLC. In short, teacher education online platforms and programs that

use them can and often do incorporate one or more (other) modes of teacher education. Typical examples include Dana et al. (2017) [39], who provide a detailed description of the Prime Online program, a year-long program designed to develop subject (pedagogical) content knowledge and pedagogical content knowledge in mathematics elementary (primary) classrooms through practitioner inquiry. The Prime Online experience consisted of "three distinct, yet integrated, segments of weekly modules consisting of content and experiences designed to build on one another" (Dana et al., 2017, p. 215) [39]. It was designed and delivered via Moodle™ (an online learning platform), with a consistent, four-component format for each module.

The learners begin each week by logging in to find an introduction and an overview of activities for that week, including aims and resources (Dana et al., 2017) [39]. They have an Anticipatory Activity that consists of some sort of provocation to enable them to reflect on prior experiences and connect them to the new material plus readings, videos and 'web quests' (ibid p. 215). The learning is assessed through assignments where participants have to apply what has been learned to their classroom practice and whole group learning and discussion is summarized and analyzed by the facilitator (ibid). Dana et al. (2017) [39] go on to discuss the program, 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. Although space does not permit us to pursue them further here, other rich examples of programs in this area are provided in Owston et al. (2008) [40], who review three program evaluations of blended teacher professional development and exploring, for example, issues around program structure and its links to expectations and relevance. As Owston et al. (2008, p. 208) [40] describe, "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".

In sum, learning platforms are clearly performing multiple functions, bringing together and organizing teacher education modes, content and activities. 71 out of 89 studies of professional development programs for STEM teachers reviewed by Hill et al. (2020) [5] for example combined new curriculum materials for teachers to use in classrooms with professional development. Elliot (2017, p. 121) [11], 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 programs can be straight-forwardly transferred into the differing dynamics of online environments.

3.2.6. Mode 6—Virtual Reality Spaces or Simulations

The final mode that we have identified but will not be pursing 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) [8] describes the "immersive, highly synchronous attributes" (p.100) of one popular virtual reality space, Second Life, as having huge potential as a distance learning tool. We refer readers interested in finding out more about virtual worlds to systematic reviews by Theelen, Van den Beemt and den Brok (2019) [41]—focused on interpersonal competence for pre-service teachers—and Billingsley et al. (2019) [42], who systematically examine VR in pre-service and in-service programs.

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 organized around principles for effective teacher education apparently have great potential to support teacher learning.

2.3. 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 program 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 yet evident in the literature (or at least from 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. 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.

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) [43][44][45]. Macià & García (2016) [43] 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 hard to compare, and that the practical impact on teacher PD is unproven and the mechanics of such impact unclear. Remote and blended professional learning communities vary in terms of (for example):

- Formal or informal organization (Lantz-Andersson et al., 2018) [44].

- 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) [44]. 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) [45].

- 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. 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 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. PLCs frequently extend other teacher activity, creating additional opportunity for collaboration, discussion and sharing. They also exist in their own right, again varied, and characterized 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. (2018) [44] describe the sharing function of PLCs as distinct from the construct of

professional learning as focusing on a narrow syllabus because it can distil information from the knowledge and experiences of the group. Nevertheless, they do caution that PLCs may not lead to deeper level learning as many often became "... sites for 'superficial' sharing of information, quick exchanges and a 'smash-and-grab' approach to becoming informed" (Lantz-Andersson et al., 2018, p. 311) [44].

Capturing some of the possible benefits of PLCs, as discussed above, Frumin et al. describe the nature, organization and timings of activity in an Advanced Placement Teacher Community (APTC). The online community is generally sustained by the activity of the teachers themselves, though each APTC does have a moderator. In contrast to other PD offers, the APTC can be accessed flexibly throughout the year and around the clock. They add: "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) [46].

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) [46] 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) [45] 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) [46] '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.' Other rich case studies we have examined in our review include Holmes (2013) [47], who presents a case study of eTwinning professional learning community, and Dede et al. (2016, Chapter 6) [38], who describe a 'Just-in-time' professional development community called the 'Active Physics Teacher Community' that "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) [38].

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Keywords