

Improving Learning

Rapid review of effective practice principles in the design and delivery of digital resources for teachers

Appendices

Part of the Life Education Australia *Being Healthy, Being Active* project

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11 June 2021

Rapid review of effective practice principles in the design and delivery of digital resources for teachers. Appendices

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ISBN 978-1-74286-671-0

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Citation (APA 7th edition)

Ahmed, S. K., Mitchell, P., & Trevitt, J. (2021). Rapid review of effective practice principles in the design and delivery of digital resources for teachers. Australian Council for Educational Research. <https://doi.org/10.37517/978-1-74286-671-0>

Acknowledgement

The authors acknowledge the support and direction provided by project director, Dr Shani Sniedze-Gregory, Dr Petra Lietz, Dr Sarah Buckley, and Elizabeth O'Grady, and editorial support from Juliet Young-Thornton. The team acknowledges feedback and support provided by Jane Lowe, Project Manager, Life Education and colleagues who provided valuable advice.

Contents

Appendix 1: Search strategy.....	1
Appendix 2: Review framework	3
Appendix 3: Details of included interventions.....	4
Appendix 4: Effective practice principles of professional learning	14

Appendix 1: Search strategy

ERIC Search – conducted 2 March 2021

Publication date range 2010-2021

S1 - 345,889 results

SU Teacher*

AND

S2 - 60,782 results

SU ("professional development" OR "professional education" OR "Professional training" OR "professional continuing education" OR "inservice teacher education")

OR

S3 - 24,659 results

SU ("educational resources" OR mentors OR coaching OR "teacher collaboration" OR "communities of practice") OR "pedagogy support"

AND

SU (elementary OR primary OR secondary OR school* OR grade OR "preschool education" OR "early childhood education")

S4 - 82,069 results

S2 OR S3 = S4

AND

S5 - 45,092 results

SU ("online courses" OR "distance education" OR "electronic learning" OR "asynchronous communication" OR "synchronous communication" OR "web based instruction" OR "virtual classrooms" OR "social media") OR "remote learning" OR "learning management system*" OR "digital resource*"

AND

S6 - 833,983 results

SU "best practices" OR SU evidence OR SU success OR SU change OR improve* OR SU "educational quality" OR SU "outcome measures" OR effective* OR SU "teaching skills" OR SU "pedagogical content knowledge" OR SU "self esteem" OR SU "self efficacy" OR SU beliefs OR SU "program evaluation" OR SU "literature reviews" OR SU "meta analysis" OR SU "randomized controlled trials" OR SU "pretests posttests" OR positive OR impact* OR SU "outcomes of education" OR increase* OR SU "teacher competencies" OR DE "teacher attitudes"

S7 - 1,371 results

S1 AND S4 AND S5 AND S6=S7

S8

S7

- Limited to 2010 to 2021 publication date range – **731 results**
- limited to English papers only – **727 results**
- remove publication types: dissertations and conference/speech/meeting papers – **662 results**

=**S8** – final result list - **662**

A+ Education Search (Australian studies) 3 March 2021

Publication date range 2010-2021

FINAL RESULTS 105

S1 -

47,897

SU Teacher*

AND

S2 –

12,246

SU (“professional development” OR “professional education” OR “Professional training” OR “professional continuing education” OR “in-service teacher education”)

OR

S3

2,270

SU (“educational resources” OR mentors OR coaching OR “teacher collaboration” OR “learning communities”) OR “pedagogy support” OR “communities of practice”

AND

SU (primary OR secondary OR school* OR grade OR “preschool education” OR “early childhood education”)

S4

13,941

S2 OR S3 = S4

AND

S5

10,945

SU (“online education” OR “distance education” OR “e learning” OR “online learning” OR “online learners” OR “asynchronous communication” OR “synchronous communication” OR “online teaching” OR “virtual classrooms” OR “social media” OR “learning management systems”) OR “remote learning” OR “digital resource”

AND

S6

93,814

SU “best practice” OR SU evidence OR SU success OR SU change OR improve* OR SU “educational quality” OR “outcome measures” OR effective* OR SU “teaching skills” OR SU “pedagogical content knowledge” OR SU “self esteem” OR SU “self efficacy” OR SU beliefs OR SU “program evaluation” OR SU “literature reviews” OR “systematic reviews” OR SU “meta analysis” OR SU “randomised controlled trials” OR SU “pretests posttests” OR positive OR impact* OR SU “outcomes of education” OR increase* OR SU “teacher competencies” OR DE “teacher attitudes”

S7 –

334

S1 AND S4 AND S5 AND S6=S7

S8

105

S7

- Limited to 2010 to 2021 publication date range –**results 148**
- limited to English papers only –**results 148**
- remove publication types: dissertations and conference papers –**results 105**

=S8 – **Final result list -105**

Appendix 2: Review framework

Types of digital education resources for teachers	Delivery mode	Delivery platform	Design elements and features	Outcomes (for teachers)	Outcomes (for students)
<ul style="list-style-type: none"> Multimedia courseware Multimedia material (text, pictures, animation, video, audio, etc.) Electronic lesson plans Teaching cases and example videos of good teacher practice Question bank/test papers Micro-lecture/micro-video Subject software and tools (Geometry, virtual lab, etc.) Online professional development courses / training modules/ workshops/ seminars / webinars Thematic pages/websites E-books/periodicals Online coaching, mentoring and expert support groups e-learning systems Informal online teacher collaboration 	<p>Synchronous (live)</p> <p>Asynchronous (facilitated)</p> <p>Asynchronous (self-directed)</p>	<p>Professional Learning Networks (PLN)</p> <p>Social platforms - Twitter, YouTube, LinkedIn, and Facebook</p> <p>Learning management system</p> <p>Resource hosted in websites – such as resource banks/ repositories</p>	<p>Accommodation of individual differences in access to learning, prior knowledge and learning needs</p> <p>Participant engagement and interactive content</p> <p>Provision of learner supports</p> <p>Acquisition or further development of Pedagogical Content Knowledge (PCK)</p> <p>Practical learning activities and usefulness</p> <p>Application of acquired knowledge and skills in practice</p> <p>Flexibility of study mode</p> <p>Relevance goal orientation, individual differences in learners (curriculum)</p> <p>Reflection and collaboration</p> <p>Program length</p> <p>Use of video</p> <p>Open access or restricted</p>	<p>Content knowledge</p> <p>Instructional practices</p> <p>Self-efficacy and confidence</p> <p>Pedagogical content knowledge</p> <p>Collaboration and engagement</p> <p>Attitudes and beliefs</p> <p>Inquiry</p> <p>Motivation and job satisfaction</p>	<p>Learning</p> <p>Engagement</p> <p>Connectedness</p>

Appendix 3: Details of included interventions

Comparisons of the various types of interventions that provide digital resources for in-service online teachers' professional development (OTPD)

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
1	Blended	Blended	Vital- continuous professional development (CPD); <i>Electronic learning management systems</i>	Bradshaw, 2012; England	General	19 months	Vital Web site; Moodle (for hosting courses), forums and wikis, Drupal (for content management of static resources), and Elluminate Live! to provide open access videoconferencing; TeachShares (for synchronous events)	Help participants (teachers) use information communication technology (ICT) to add value to lessons and find new ways to engage their students. Teacher level: Pedagogical practices; Collaboration and engagement Student level: Student engagement	<ul style="list-style-type: none"> • Online registration function for tracking participants' engagement • Tools for designing, facilitating, and hosting participants' own events • Local, face-to-face technology support • Courses offered in multiple formats • "Fifteen-minute CPD" - online structured and facilitated staff development opportunities in "bite-size" chunks • Recording of the live sessions which could be downloaded by participants who could not attend • Special interest groups established for further engagement and collaboration 	The approach and ethos of recognizing, and building on, the expertise of practitioners and developing an infrastructure to support bottom-up sharing of that expertise. The collaboration and engagement promoted through the program helped teachers move from being "users" to active "members".	
2	Asynchronous	Facilitated	International Education and Resource Network Science Technology and Math (iEARN-STM) online professional development course; <i>Multimedia courseware</i>	Chitanana, 2012; Cameroon, China, Egypt, Indonesia, Iran, Jordan, Lebanon, Nigeria, Oman, Pakistan, Palestine, Romania, USA and Zimbabwe	General	8 weeks	Moodle learning management system	Upskill teachers and provide them a highly interactive platform to learn collaboratively and share their students' work Teacher level: Pedagogical practices; Collaboration and engagement	<ul style="list-style-type: none"> • Use of multimedia content, including videos to capture real life contexts • Online conversations through discussion forums for collaborative/peer-learning and reflective thinking • Hyper-textuality of the online medium 	Encourage high levels of learning through collaboration and reflection from the participants.	Feedback could be limited due to late responses by participants and some may become disengaged and demotivated because they have higher expectations of social interactions through the forums.
3	Blended	Blended	Virtual Learning Environments (VLEs); <i>Electronic learning management systems</i>	Hilli, 2020; Finland	General	1.5 years	LMS Fronter and the integrated video conferencing system- Blackboard Collaborate	Create interactive, communicative, collaborative, and digital environments Teacher level: Pedagogical practices; Attitudes and beliefs; Collaboration and engagement	<ul style="list-style-type: none"> • Combined social media and Learning Management Systems (LMS) • Provided assessment practices and tools 	Supported professional development and reduced the teachers' professional isolation, especially in rural areas. Improved the efficacy of assessment through collaborative writing (e.g., evaluation forms), systematised evaluation (e.g., written measurements) and they brought parents into the assessment process.	VLEs can constrain teaching practices by offering only certain tools for assessment.

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
4	Asynchronous	Self-directed	Social Emotional Learning for Teachers (SELF-T) course and its components; <i>Multimedia courseware</i>	Lang, 2020; USA	General	3 hours	Department website	Train early childhood teachers on stress-reduction and resiliency strategies. Teacher level: Attitudes and beliefs;	<ul style="list-style-type: none"> Learn, Explore, Apply and Demonstrate (LEAD) format was used Learners reflected on how stress works in their bodies, how they typically respond to stress Introduced participants to new stress-reduction strategies such as belief disputation, emotional reappraisal, controlled breathing, and visualization 	<p>Easy to understand, useful, and positively affected early childhood educators' work with children.</p> <p>Participants move at their own pace, and complete a number of small exercises throughout the course to explore and apply concepts.</p> <p>Provides ECE professionals important information in an efficient manner that is easily scalable across cities, regions or States.</p>	It may have been more efficient to provide online activities and record keeping instead of asking participants to complete the course activities in their printed activity sheets provided in the course-packet.
5	Asynchronous	Facilitated	My Teaching Partner-Secondary (MTP-S); <i>Digital coaching and mentoring</i>	Allen, 2015, 2011; USA	General	2 years	Private, password-protected program Web site, phone	<p>Improve teacher–student interactions and student achievement.</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement</p> <p>Student level: Student engagement</p>	<ul style="list-style-type: none"> Participating teachers send their coaches video recordings of themselves in which they are delivering a lesson. Coaches review these recordings and provided feedback on a private, password-protected web site. Teachers review feedback and respond to the coaches' prompts A 20- to 30-minute phone conference follows where the coaches and teachers plan ways to enhance interaction Student academic achievement was assessed using the Commonwealth of Virginia Standards of Learning (SOL) testing system 	<p>Improved the quality of secondary school teaching and lead to meaningful gains in student achievement.</p> <p>Highly cost-effective even when conducted across a two-year period.</p> <p>Only requires about 20 hours of teacher in-service training, (over the two years).</p>	
6	Blended	Blended	The Quality Teachers for Quality Students (QTQS) project: Electronic mentoring system for beginning teachers; <i>Digital coaching and mentoring</i>	Suk Hwang, 2012; USA	General	–	Blackboard and Skype	<p>Support the development of an electronic professional learning.</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement</p>	<ul style="list-style-type: none"> Provided initial training and orientation, ongoing support, frequent updates and current issues in student achievement, best instruction practices, and individual mentoring support from online mentors to address immediate concerns Electronic mentoring activities through Blackboard system setup and electronic tasks Video-Based Self-Reflection of Instruction (VSRI) activity—VSRI checklist, procedures of VSRI, and mentoring; and Evaluation of electronic mentoring system - survey instrument, data analysis, and summary of findings 	<p>Reduced the time constraints of face-to-face mentoring, allowing teachers to communicate and receive constructive feedback at times that best suited them.</p>	It took very long to convert mentee video recordings into a format compatible with the Blackboard Digital Drop Box.

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
7	Blended	Blended	iCoaching; <i>Digital coaching and mentoring</i>	Randolph, 2019; USA	General	_	FaceTime	Improve coaching efficiency. Teacher level: Pedagogical practices; Collaboration and engagement	<ul style="list-style-type: none"> Used a bug-in-ear (BIE) coaching method using iPods, Bluetooth earpieces, and the FaceTime application Coaches send prompts to remind the teachers to deliver the desired behaviour in classroom The teacher and coach work as a team throughout the process The teacher and coach either attend a PD session based on the evidence-based practices (EBP), or complete an online training or module focused on the EBP 	The program involves teachers from the beginning to empower them and engage them in every step of the process. Technology enables teachers to receive real-time coaching comments.	
8	Asynchronous	Blended	Teacher professional development MOOC; <i>Massive Open Online Courses</i>	Koukis, 2018; Greece	Language (Greek)	_	Open eClass learning management system; Google Docs	Enhance Greek teachers' knowledge, skills and attitudes to integrate collaborative writing in their instruction. Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge	<ul style="list-style-type: none"> Short tutorials in the form of video-lessons were produced and made available through the on-line platform Active engagement in the learning tasks, peer support and discussions, and reflections on teachers' achievements One tutor and one assistant acted as the moderators-facilitators for teachers' activities 	Supported teachers' ability to complete this course and enhanced their achievements through individual engagement, peer interaction and mutual support, and collaborative creation of writing artefacts using Google Docs. Discussion forums appeared to be a very effective tool in this MOOC and the majority of teachers were very active contributors to the forum.	The participating teachers chose to interact mainly with peers in their own group rather than with other colleagues in the MOOC.
9	Blended	Blended	Exceptional Coaching for Early Language and Literacy—enhanced (ExCELL-e); <i>Digital coaching and mentoring</i>	Hindman, 2015; USA	Language (English)	1 year	Online – web-based platform; Skype or phone	Develop preschool, kindergarten, and first-grade teachers in high-poverty settings. Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge	<ul style="list-style-type: none"> All modules addressed instruction of native speakers of English, as well as Dual- language learners (DLLs) Teachers completed an embedded check your understanding assessment, including multiple-choice or true–false items, on which they aim to score 100% (with missed items resulting in a check-in from a coach) At the end of each module teachers videotaped themselves using target strategies in their classrooms, and received personalized feedback from an expert coach with whom they work throughout the year 	Having an advisory board of teachers was invaluable in constructing content and presenting it in appealing and comprehensible ways.	It involved a considerable time commitment from the teachers.
10	Blended	Facilitated	Mathematical Quality of Instruction (MQI) - <i>Digital coaching and mentoring</i>	Kraft, 2019; USA	Mathematics	>1 year	Video: Adobe connect web	Coach teachers on existing practices and long-term plans for the year through one-on-one conversations Teacher level: Pedagogical practices; Attitudes and	<ul style="list-style-type: none"> Teachers used self-captured video to analyse their own instruction, and reflect on how to improve their instruction on specific MQI items 	Participating teachers engaged in critical analysis of their own instruction and had shared responsibility for making a plan of action.	There were no detectable effects on student achievement from the changes in teachers' instructional practices.

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
								beliefs; Collaboration and engagement; Pedagogical content knowledge	<ul style="list-style-type: none"> Regular web-based meetings with coaches fostered a degree of informal accountability and helped teachers to stay engaged 	Web-based programs like MQI Coaching (per-cycle basis) are likely to be more cost effective than site-based programs.	
11	Asynchronous	Facilitated	Matematikk Mooc 1 ; <i>Massive Open Online Courses</i>	Krzyszowska, 2020; Norway	Mathematics	3 weeks	MOOC - LMS	<p>Refine teachers' practice by aligning an existing learning design with the Collaborative learning (Co) model.</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge</p>	<ul style="list-style-type: none"> A discussion forum was used as the main platform for interaction Facilitator's main role was publishing and explaining problem-based tasks in the discussion forum 	<p>A meaningful learning experience was created through the interplay of the three key elements: social, teaching and cognitive presence.</p> <p>The design and organisation (procedures, course content and the scheduled events predefined in the LMS) was considered to be more important than facilitation and direct instruction.</p>	The design overlooked the significance of a sense of belonging and the connectedness among the course participants and did not include explicit steps for building a community.
12	Asynchronous	Blended	GeoGebra: an open-source Dynamic and Interactive Mathematics Learning Environment (DIMLE); <i>Electronic learning management systems</i>	Bu, 2013; USA	Mathematics	1 year	Course Management System (CMS) and open-source DIMLE technologies; interactive web-units designed using Quandary®	<p>Supports mathematics teaching and learning</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge</p>	<ul style="list-style-type: none"> Applied dynamic demonstration, computation, graphing, exploration, alternative solutions, and online mathematical communication Instructional videos illustrating the functions of GeoGebra, the processes of problem solving, and their relevance for mathematics teaching was shared with the participants Interactive web-units provided instructional support Weekly forums were a very useful social channel of communication and problem solving 	Participants found Quandary-based support very helpful; another resource, team scaffolding (from DIMLE tools) was judged to be more flexible and appropriate than that traditional instruction.	Some participants were overwhelmed by the combination of the unfamiliar mathematical problems, new ways of thinking, and the use of new DIMLE technology tools.
13	Asynchronous	Blended	Online mathematics lessons, offered through a distant education course; <i>Electronic learning management systems</i>	Brodahl, 2016; Norway	Mathematics	-	On-Line - text and video podcasts; through the LMS-Fronter	<p>Understand how in-service teachers perceived podcast quality based on design dimensions.</p> <p>Teacher level: Pedagogical practices; Pedagogical content knowledge</p>	<ul style="list-style-type: none"> Video podcasts were recorded using the screen casting software Camtasia (v.7) and power point slides Each podcast was developed with stand-alone instructions created for and implemented in a particular online lesson, along with a PDF-copy of the power point presentation For one topic, two series of podcasts were offered each with a clickable, two level, table of contents Content and activities were arranged across nine online lessons provided as a multimedia text consisting of an 	Teachers found the quality and design of the video podcasts including voice and graphic delivery, and length and chunking of information to be quite useful.	Teachers identified some obstacles such as, video lengths, narrator mispronunciations, and the verbatim reading of materials.

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
									introduction, table of contents, learning goals, and followed by chapters of different topics in the subject area <ul style="list-style-type: none"> A digital text-video format was chosen with clickable video thumbnails integrated in the body text in a tabloid fashion Chapters comprised of tasks and exercises as well as quizzes and surveys created in the LMS test tool with links to external resources 		
14	Blended	Blended	"Robotics and Hands-on Activities in the Classroom" online teacher professional development (oTPD) courselet; <i>Multimedia courseware</i>	Ostaszewski, 2011; Canada	Science (robotics)	–	Customised social networking website (Web 2.0 tools)	Delivery of instructional packages and the creation of learning artefacts (i.e. online lesson plan) to demonstrate learning, (delivered within a social networking site) Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge	<ul style="list-style-type: none"> An online educator community was established via social networking software that was customized to provide members with tools commonly found in social media sites like Facebook and Ning or learner management systems like Moodle 	Effectively supported TPD learning about the LEGO robotics content. Allowed teachers to control their access and participation in relevant activities and promoted the development of a network of relationships.	While some participants were familiar with the Web 2.0 tools it was new to other teachers and they required additional time to learn how to navigate and use the platform. Required about 10–15 hours of teacher interaction through online forums, blogs, videos, and other social media.
15	Asynchronous	Self-directed	Exploring Florida Science environment; <i>Electronic learning management systems</i>	Cavanaugh, 2010; USA	Science	–	LMS	Increase the content knowledge and skills of all secondary science teachers, and provide a rich and innovative classroom resource for science students. Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge	<ul style="list-style-type: none"> The module development was guided by E-Learning for Educators standards and evaluated for content, pedagogy and usability based on established guidelines using rubrics on science content and technology for delivery Materials designed to connect teachers with practitioners in the field used personal stories to increase closeness Content was examined for accuracy, currency, completeness for grade level, thoroughness for benchmarks, and appropriateness of science skills An accessibility review for the module design was undertaken by an instructional designer 	The intervention used compelling media to increase participants' engagement with the platform.	
16	Synchronous	Facilitated	Live, Short-Courses for NASA Explorer Schools; <i>Multimedia courseware</i>	Marrero, 2010; USA	Science	4- 6 one-hour sessions	NASA's DLN (digital learning network); a videoconferencing tool	Provide participants an opportunity to actively learn content and applications for the classroom. Teacher level: Pedagogical practices; Collaboration and engagement;	<ul style="list-style-type: none"> Seven short- live/ online courses (4-6 one-hour sessions), with independent assignments as follow-up activities between the sessions Teachers participated simultaneously logging into an online classroom or using a telephone to dial into a conference call. 	Provided participants expert training and resources, which they may not have had access to through their local district. The live format was valuable for professional development in science	Some participants had issues with the technology during the session and not much technological support was provided as part of the intervention.

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
								Pedagogical content knowledge	<ul style="list-style-type: none"> The course instructors used embedded technological resources, such as online quizzes/polls, as a formative assessment and as a way for participants to share ideas quickly. Real-time Q&A during the live sessions. Other distance learning opportunities were also additionally offered for e.g., one-session webinars and events through NASA's DLN, a videoconferencing tool. 	education as the content can often be challenging.	
17	Asynchronous	Self-directed	GO! Network 'learning paths'; <i>Electronic learning management systems</i>	De Smet, 2016; Belgium	Science (Biology)	–	Information systems running on a server (web-based)	<p>Support biology teachers to set learning paths for their grade 8 students on a topic and develop a road map for individual learners.</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge</p> <p>Student level:</p> <p>Learning outcomes; Engagement</p>	<ul style="list-style-type: none"> Interactive web-based tools supported the learning of specific concepts by enhancing, amplifying, and/or guiding the cognitive processes of learners Learning activities were used for learners and instructors to share knowledge and experiences Offered additional tools like document publishing, assessment modules, and wiki 	Useful features related to the quality and multimedia functionality.	<p>Problems with computer access, training and support to help teachers becoming more effective or efficient.</p> <p>Teachers took some time to adjust to the new learning methods while their students adapted quickly.</p>
18	Asynchronous	Self-directed	iPlan tool; <i>Electronic learning management systems</i>	Tekumru-Kisa; 2019, USA	Science (Biology-Genetics)	4 weeks	Web-based - Online learning communities	<p>Support both the communication and the practice Science teachers.</p> <p>Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge</p>	<ul style="list-style-type: none"> Tasks designed with macro and micro views - the macro view included a verbal task description, and helped to situate the task within the larger curriculum; the micro view included many practical details, such as amount of time, class grouping (i.e. whole class, small group or individual work) and even particular questions that could be asked of students Other useful functional features included, the 'target icon' to help teachers understand how much conceptual progress on a big idea students may require, and the 'important icon' for supplemental information 	Fostered a learning-oriented community of practice.	<p>Several specific macro view features were not considered helpful by some teachers.</p> <p>Not having a facilitator slightly limited participants' engagement.</p>

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19	Asynchronous	Facilitated	CSER MOOC series	Vivian, 2014; Australia	Digital Technologies	21 hours	Google Course Builder; WordPress for posting tasks	Equip teachers to teach the Australian Curriculum Digital Technologies courses Teacher level: Pedagogical practices; Collaboration and engagement;	<ul style="list-style-type: none"> All course materials were available online at https://csermoocs.adelaide.edu.au 5-minute concept videos and worked examples that were linked to curriculum learning objectives were quite useful 	<p>All materials are openly licensed.</p> <p>The MOOC is mapped to national teacher standards.</p> <p>There are specific learning goals.</p>	<p>Technical development (in the form of coding) was required to construct the course using the web guides, as well as support and maintenance.</p> <p>The MOOC was expensive to develop and deliver.</p> <p>It is funded by the Australian government and Google.</p>
20	Blended	Facilitated	Online role-play	Zhang, 2016; China	General	3 weeks	Chat room	Help teachers simulate online role-play as a tool to teach collaborative reasoning. Teacher level: Pedagogical practices; Collaboration and engagement	<ul style="list-style-type: none"> The course instructor participated in the activity by assuming a role or stepped out of the role to send online messages, monitoring and guiding the process The asynchronous Professional Learning activity was followed by a 1-hour synchronous debriefing, reflection session 	<p>Participants developed their ideas through collaboration.</p> <p>The asynchronous forum helped collaborative argument, improved interaction & encouraged thoughtful communication.</p> <p>It enabled less vocal learners to share opinions.</p> <p>Participants recognised the value of conducting research on the topic and collecting evidence before posting.</p> <p>Some participants felt more comfortable by the anonymity of the platform.</p>	<p>Success hinges on topics being intriguing and challenging – this is time consuming, specialist skill.</p> <p>There was difficulty in keeping track of the asynchronous conversation, involving lots of scrolling back, and participants missed exchanges when they were typing.</p> <p>It was difficult for some participants to maintain the assigned role.</p> <p>Accessibility was an issue with a screen reader not working in the chat room.</p>

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
21	Blended	Blended	Agile professional development; <i>Electronic learning management systems</i>	Flavell, 2019; Australia	General	1 semester	LMS	Support participants' teaching strategies Teacher level: Pedagogical practices; Collaboration and engagement	<ul style="list-style-type: none"> The emphasis was on regular feedback, flexibility and student-centred approach After a 2-day initial workshop, the participants taught in pairs for 1 semester Participants explored a variety of teaching strategies, e.g., Fishbowl, You-Tube technology, goal setting, and the flipped classroom) as well as new technologies 	<p>Post-surveys showed improved ease of use in intervention group. Intervention group more aware of the resources. Participants provided useful applications and tips, and practical strategies when technologies did not go to plan. Increase in curiosity and confidence. Participants reported learning varied teaching strategies. Participants increased their understanding of the drivers for educational technology use.</p>	<p>Resourcing and timetabling were challenging.</p> <p>Casual tutors had little opportunity to embed innovations into their teaching.</p>
22	Asynchronous	Facilitated	Connectivist open online class (OOC); MOOC	Graham, 2015; Alaska	General	6 weeks	Multiple online tools PLN Social bookmarking Communication forums	Develop connectivist pedagogy in practising teachers. Teacher level: Pedagogical practices; Collaboration and engagement	<ul style="list-style-type: none"> A learning design incorporated within an In-service Masters of Educational Technology The class focussed on knowledge generation and networked learning The class had 1-week of orientation at the beginning of each phase of the course, then 4 weeks of guided interaction, with a final week for those taking the course for credit to present their final products 	<p>Provided an opportunity for authentic professional development and collaboration, particularly for teachers in remote areas.</p> <p>Course was for credit, and 98% completed successfully.</p> <p>Resources curated by participants were available to all participants.</p>	<p>The unfamiliar pedagogical framework was met with confusion: people thought they were signing up for an online course.</p> <p>High frustration amongst some 20% of participants who remained resistant to connectivist pedagogy throughout the experience.</p> <p>Required too many accounts and logins.</p>

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23	Blended	Facilitated	Carpe Diem; MOOC	Salmon, 2017; UK	General		Multiple online tools; social learning techniques	Help staff develop an online module and understand online tools available. Teacher level: Pedagogical practices; Collaboration and engagement	<ul style="list-style-type: none"> Staff learned to design the module, collected online examples of good practice, illustrated by audio clips of staff The module included online tutorials, and linked to a separate website of learning designs Participants were taught to concentrate first on the jobs that teachers need to be able to do, rather than starting with tool functionality Participants reflected on their objectives in a learning diary The platform automatically generated certificates of completion The course was staffed by trained facilitators 	<p>Helped inform staff of innovations in learning and teaching practice.</p> <p>Occurred within teachers' normal working environment.</p> <p>Catered for staff who preferred to study in their own time as well as those who preferred synchronous.</p> <p>Cohort learning proved extremely popular with participants; and peer learning greatly contributed to the experience.</p>	
24	Blended	Facilitated	iLearn about ESL 2.0 Professional Learning Community; <i>Electronic learning management systems</i>	Haratsis, 2011; Australia (NSW)	General	2 years	Moodle Ning	Develop teachers' knowledge, skills and understanding in effective English as Second Language (ESL), literacy and numeracy teaching. Teacher level: Pedagogical practices; Collaboration and engagement; Pedagogical content knowledge	<ul style="list-style-type: none"> The ESL executives led a range of face-to-face and online professional learning for whole school teams A closed online professional learning community was established, first on Moodle, then migrated to Ning Developed e-tips for building an architecture of participation 	<p>The professional learning community enhanced networking, resourcing and communicating.</p> <p>Led to adoption by other professional networks.</p> <p>Accommodated mobile technologies.</p> <p>Archive on DVD made resources available beyond the life of the project.</p>	<p>This was a high-cost program.</p> <p>A lot of time was spent on socialising activities to build community.</p> <p>The online platform affected participation.</p> <p>Changing tools midstream was quite disruptive, and inefficient.</p> <p>Some tools become outdated/lost support.</p>
25	Asynchronous	Self-directed	Digital science resources and videos on website: <i>Contemporary Science Practice in Schools</i> <i>Digi Explanations</i>	Blom, 2019; Australian (VIC)	Science	Self-directed	Website	To provide professional learning resources relating to contemporary issues in science	<ul style="list-style-type: none"> Collection of resources purposefully designed and organised for Australian science context suite of engaging and varied resources and activities updated with new resources to reflect current research in science 	<p>Produced by universities in collaboration with scientists, pre-service teachers, teachers, and education academics.</p> <p>Aligned with the Australian and/or Victorian Curriculum for secondary schools.</p> <p>Accessible to any teacher, user-friendly website with simple navigation.</p>	<p>Lack of coherence due to multiple contributors</p> <p>Series of separate sites</p>

No.	Communications mode: Asynchronous / Synchronous / Blended	Delivery mode: Self-directed / facilitated / Blended	Intervention name; type	Study details (first author, year; Country)	Focus (content/ subject area)	Length	Platforms	Purpose; Outcomes	Key features	Pros	Cons
26	Synchronous	Facilitated	Video conference <i>Sydney Opera House's Digital Education Program</i>	Dezuanni, 2015; Australia (NSW)	Music	2 hours	Connected Classrooms (NSW DoE)	observational and videotape data collected during this live professional development	<ul style="list-style-type: none"> Synchronous one-off live event that aimed to replicate a typical 'live' professional development event While there are significant differences in the type of learning that occurs in a remote music interaction, the online space provides a legitimate and potentially transforming experience for primary school teachers. 	Collapses space and time to bring people together in a way that would otherwise be impossible	Communication was difficult between the presenter and all the remote sites, particularly audio back from remote No live online chat
27	Asynchronous	Self-directed	Professional learning smartphone app	Dwyer, 2019; Australia (NSW & NT)	Early childhood	Self-directed	Mobile phone	How do educators use existing digital technology (particularly smartphones), in and out of the workplace, to support their professional role and to construct a Professional knowledge base?	<ul style="list-style-type: none"> use of commercially available apps and software designated for professional use a) formal resources (i.e. websites etc.), which we classified as those existing in the gov.au domain, reserved for Australian government entities, the org.au domain, occupied by non-profit organisations, or the.edu.au domain b) informal resources, classified as any other digital resources, including commercial websites, social networking websites, discussion forums and other multimedia-sharing platforms. 	25.7% of educators (19/74) reported using existing childcare apps for lesson planning	Most educators (79.5%; 58/73) did not list any formal resources. Of the 20.5% (15/73) who did, eight listed one, and seven listed two. Educators listed between zero and six informal resources Educators working in centres in higher SES suburbs listed more informal resources than those working in lower SES suburbs 13.9% were interested in 'professional development' apps
28				Herbert, 2016; Australia				<p>What are rural teachers' perceptions of online professional learning, with particular respect to its value in enhancing their understandings?</p> <p>What features of online professional learning would meet the needs of rural teachers?</p>			

Appendix 4: Effective practice principles of professional learning

A mapping of six examples of principles of professional learning from Australian and international organisations that were used to inform the analysis of the literature in the rapid review.

Principle	Sub principle	EEF 2020b	Cavanaugh & Dawson 2010	QM 2015	ACER 2013	Global Online Academy	NESA 2021
1. Relevance	Accreditation				Contribute to ongoing career development and in many cases can be credited towards qualifications		Coherence between teacher professional learning and external factors such as government, school/service and sector policy, as well as teaching standards and assessment are linked to clear and relevant goals that are related to student/child outcomes
	Needs-based				Based on evidence of participants' current performance context and available resources; participants' knowledge and capabilities		Content-focused: relevant, focus on specific subject knowledge together with pedagogical content knowledge teaching strategies associated with specific curriculum content
2. Educational value	Assessment & evaluation			Assessment strategies are integral to the learning process and are designed to evaluate learner progress in achieving the stated learning objectives or mastering the competencies.	Continually evaluate professional learning activities to improve quality.	Assessments are aligned to learners and learning goals: allow for multiple attempts, support students working at their own pace	Recognise the experience and prior knowledge of learners
	Engagement in learning, Intensity and duration				High expectations: set achievable high-level goals for all participants	Challenge participants: cognitively complex, personalised work that asks them to apply knowledge in order to demonstrate learning outcomes.	Of a sustained duration that allows teachers to: plan and consider how their new learning might best support their students/children evaluate the impact of the learning refine future approaches

Principle	Sub principle	EEF 2020b	Cavanaugh & Dawson 2010	QM 2015	ACER 2013	Global Online Academy	NESA 2021
	Feedback				Encourage and incorporate formal and informal feedback in multiple formats.	Diversifying feedback: Teacher-to-Student, Teacher-to-Student(s) (class or groups), Student-to-Student, and Student-to -Teacher.	Include opportunities for feedback and reflection
	Instruction and learning activities				Active & reflective: focused on addressing participants' concerns using and modelling teaching and learning methods such as collaboration, action research, use of tools and frameworks, data analysis, presentations and reflection in a wider context	Instructions cover essential information students need in order to drive their own learning: Who, What, Where, When, Why, How?	Model effective practice: have a vision of practice on which to anchor their own learning and growth
	Learning outcomes clearly stated			Learning objectives or competencies describe what learners will be able to do upon completion of the course		Intended outcomes for a learning experience are clearly articulated. Time and support to develop understanding of the meaning and relevance of those outcomes	
	Reflection and application of learning					Reflection: compose and share reflections and self-assessments that capture what and how they have learned.	Job-embedded and/or provide opportunities for transference of learning
	Structure of learning and self-direction			The overall design of the course is made clear to the learner at the beginning of the course.		Pacing Guide: visual or graphic guide to how to organize time and tasks for the learning experience is posted Motivation, skills, and habits associated with more self-driven learning	

Principle	Sub principle	EEF 2020b	Cavanaugh & Dawson 2010	QM 2015	ACER 2013	Global Online Academy	NESA 2021
3. Managed & flexible learning environment	Accessibility, Equity		Accessibility: Free from bias, accessible for all or has appropriate accommodations	The course design reflects a commitment to accessibility and usability for all learners.		Ensure online tools and experiences are accessible to all learners Privacy and parameters you must work within to ensure your and students' online safety and privacy Equity: aware of learners' technological capabilities as well as the support available to them Online safety. Acceptable Use Policy	
	Delivery mode	Professional development can be supported effectively remotely Remote coaching, mentoring and expert support can be effective alone or as part of broader PD programmes				Use of time: Balance. When should we learn synchronously / asynchronously and what is the best use of that time?	
	Navigation, Usability		Efficiency of navigation: well-organised, visually and functionally consistent and easy for teachers to navigate Usability of the media by the intended audience: works with school technology and typical teacher skills	Course technologies support learners' achievement of course objectives or competencies		Balance: The experience uses video, images, hyperlinks, audio, and other multimedia elements to support students in contextualizing, navigating, and focusing on learning goals.	

Principle	Sub principle	EEF 2020b	Cavanaugh & Dawson 2010	QM 2015	ACER 2013	Global Online Academy	NESA 2021
4. Social presence	Learning with others			Course activities facilitate and support learner interaction and engagement	Practice-oriented: conducted in a social context, tailored to individual and local needs and designed to encourage immediate practice and sharing in participants' workplaces	Diversify interactions: teacher to class, teacher to individual, learner to class, learner to learner, small group	Involve active collaboration
	Support for all aspects, including from school leaders: protected time, training, platform ease of access	Remote professional development requires supportive school conditions (support from leaders, protected time, tech-specific training, platform ease of access)				Routine: Establish and publish a clear, predictable routine for publishing and organizing online learning material and for communicating with students.	
	Teacher Presence					Presence: Make presence known through frequent asynchronous and synchronous communication that includes your face and voice, through rapid and helpful responses to questions, through timely and effective feedback, and through active participation in class activities. Build trust. Teacher demonstrates care, is clear and responsive in communications and expectations. Relationships: Made time before, during, and after an online experience to personally know, check in on, and get feedback from students	

Principle	Sub principle	EEF 2020b	Cavanaugh & Dawson 2010	QM 2015	ACER 2013	Global Online Academy	NESA 2021
	Technical support		Adequacy of support for users: technical support to enable independent use	The course facilitates learner access to support services essential to learner success.		Support: Create and publish a clear process for how students can get support, how you will intervene in the event that they need support	
5. Quality content	Instructional materials, Resources	Interactive content and opportunities for collaboration hold promise for remote professional development The use of video can enhance remote PD	Professionalism of media: attractive, functional and appropriate for teachers Clarity of visual design: aesthetic design presents and communicates information clearly throughout	Instructional materials enable learners to achieve stated learning objectives or competencies.	Presenters and facilitators have deep content knowledge and teaching skills. Informed by evidence from: large scale data collections and international research, and research into practices that have worked in similar settings	Playlists, Not Packets: Give choice in content. Content selection is diverse media and draws from a variety of sources, academic and otherwise	