

Global emergency remote education in secondary schools during the COVID-19 pandemic

A SYSTEMATIC REVIEW



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There were no conflicts of interest in the writing of this report.

Contributions

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Foreword

IPPO is pleased to publish our first systematic review. This work has given us the opportunity to review an area of evidence in depth and explore an issue fully from a number of angles. Our intention is that the review is a resource for those with interest and need in learning more about how online and distance learning occurred during the COVID-19 pandemic, providing insight and guidance for future periods when teaching and learning have to take place online. We also hope it will be a useful input into future decision making. In addition to systematic reviews, IPPO is undertaking Rapid Evidence Reviews and producing a range of other outputs. Please see our [website](#) for more information.

Professor Joanna Chataway

Principle Investigator

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Abstract

The worldwide shift to emergency remote education in 2020 as a result of the COVID-19 pandemic impacted billions of students and teachers. A range of teaching and learning strategies were employed by schools as a result, despite confusing and sometimes contradictory government guidance, with systemic issues such as equity and access impacting heavily on disadvantaged students. In light of the findings of a recent IPPO [evidence snapshot](#) and [roundtable event](#), and in order to gain further insight into how emergency remote education was experienced by secondary school students, parents and educators, a systematic review was conducted that collates and synthesises primary empirical studies across five key research questions focusing on student engagement, online assessment, peer collaboration, parent engagement, and future directions for online learning. Studies were searched for in May 2021 using Web of Science, Scopus, ERIC, Microsoft Academic Graph, ResearchGate and the COVID-19 living map, and were included if they focused on teaching and learning using blended or online approaches in secondary schools during the pandemic, that were published in English. Following quality assessment on scope and methodological rigour, 81 studies were included for narrative synthesis. The research studies were conducted in 38 countries, with 37% of studies from low or lower-middle income countries, and 63% from upper-middle income or high-income countries. Most of the evidence came from students (64%), followed by teachers (53%), with very few studies exploring the perceptions and experiences of parents (6%) or school leaders (5%). Findings reveal that self-regulation and understanding were the most frequently reported indicators of student engagement, with online assessment tools, learning management systems with collaborative tools, live synchronous lessons with peer and teacher interaction, and teacher-made videos considered particularly engaging. Social isolation was the most frequently reported indicator of disengagement, characterised by poor attendance in live lessons, a lack of opportunities to seek help with challenges and difficulties facilitating peer collaboration. Although many articles reported that assessment online was particularly challenging, 21 different types of online assessments strategies were identified, with online quizzes and formative online feedback the most frequently used. Live marking or recorded feedback and assessment were found to be particularly beneficial, as providing feedback during live lessons was sometimes challenging. Peer collaboration was facilitated through peer assessment, inquiry-based group work and experiments, aided by the use of collaborative software and combining multiple applications. Parental involvement and support contributed to student learning, although issues of equity impacted the extent to which they could engage with their children's learning, alongside gaps in family content knowledge and technological skills. Numerous implications for future policy relating to online and blended learning are provided.

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Executive Summary

The issue of concern

Globally, education has been subjected to a varying degree of digitalisation over the last few decades. While online and blended learning are becoming more common in higher education, uptake in compulsory education varies, as there is debate on the extent to which teaching and learning can and should be done online. Due to the complexity of blended learning, particularly in compulsory education, the debate has focused on inequality caused by the digital divide and teacher and student IT skills, discussion about the kind of teaching and learning that can be done online, and the potential impact on student engagement, motivation and learning outcomes. The widespread school closures provoked by the COVID-19 pandemic hastened decision making relating to formal online learning, and the question of *if* and *to what extent* education should be digitalised transformed into an expectation that secondary schools would provide not only blended, but fully online learning.

How did we find this research?

This review identified and synthesised research evidence on blended and online learning in secondary schools during the COVID-19 pandemic. Relevant studies were defined as those that focused on participants from secondary schools (either solely, or where secondary school data could be clearly extracted), were published in English, and had a focus on teaching and learning during the pandemic. Following a search through five databases and platforms, as well as ResearchGate and a previously published [rapid review](#), 81 studies were identified for inclusion.

Findings and recommendations

The studies included in this review were undertaken in 38 countries. 37% of studies were from low or lower-middle income countries, and 63% were from upper-middle income or high-income countries. Most of the evidence came from students (64% of studies), followed by teachers (53%), with very few studies exploring the perceptions and experiences of parents (6%) or school leaders (5%). Very few studies focused on vulnerable students, with only five studies including evidence about students with special educational needs and disabilities (SEND), one study about migrants and refugees, seven studies including students from lower socio-economic backgrounds, and one study of students with lower levels of attainment. While the shift to emergency remote teaching has sparked a discussion about whether online teaching suits particular forms of learning, complementing classroom teaching, or whether all learning should be in a physical classroom, this report focuses on what worked well in the online mode.

Finding 1: Use of technology during the pandemic

The most frequently used technologies were synchronous collaboration tools (e.g., live video lessons), knowledge organisation and sharing tools (e.g., Google Classroom), text-based tools (e.g., WhatsApp, email), and multimodal production tools (e.g., recorded videos). More studies from high-income countries reported using live video lessons compared with those from lower middle-income countries. Conversely, text-based tools such as WhatsApp were more common in lower-middle and low-income countries.

Recommendation 1: On a global level, digital infrastructure, accessibility, quality and usability are still preventing equal access to education. Effective uses of technologies should continue to be embedded into education going forward to prevent perpetuating digital exclusion. Technology choice for online learning should be governed by the student's ability to reliably access and use the tool; which will vary geographically and perhaps even within a class.

Finding 2a: Student engagement and motivation

Despite the challenges of emergency remote education, the number of studies reporting at least one measure of engagement was equal to the number of studies reporting instances of disengagement. Some teachers reported that some students were more motivated to learn and complete schoolwork than prior to the pandemic, citing an increased ability to study and problem-solve independently, as well as a greater sense of responsibility. Students reported that teachers who checked in with them via email or phone, gave them timely feedback, used collaborative tools and made their expectations clear, were motivating.



The most commonly reported engagement/motivation domains and the learning approaches that were found to be engaging/motivating for students.

Finding 2b: Student disengagement and demotivation

Absence was the most common form of behavioural disengagement reported, followed by poor conduct and task completion. Some teachers encountered poor attendance at live lessons, as well as students who kept their cameras turned off. Some students attended live lessons, but then did not engage further in the virtual classroom. Given the abrupt shift to remote learning during the pandemic, social disengagement was unsurprisingly a factor, with over a quarter of studies mentioning students' social isolation.

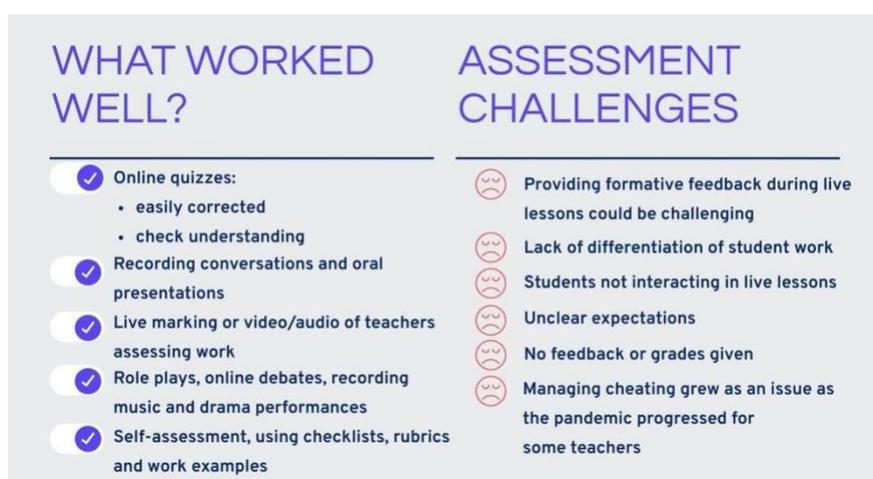


The most commonly reported disengagement/demotivation domains and the challenges leading to disengagement/demotivation among students.

Recommendation 2: Teachers need to be aware of students' conditions for learning and general well-being. Synchronous learning activities with interaction and support was found to keep students engaged, while formal and informal social interaction between peers helped well-being. Traditional school structures can develop to proactively check in with students to learn about their needs in online modes. Scaffolding (i.e., not delivering all learning materials at once), varying learning tasks and giving clear instructions may prevent students from feeling overwhelmed and confused.

Finding 3: Emerging online assessment practices

Globally, governments responded differently to the online learning switch, with some countries such as South Korea, Senegal, Morocco and the UK halting standardised assessments. Nevertheless, several studies reported creative ways to assess students online during the pandemic, with 21 different online assessment types identified. Several studies reported that online quizzes were beneficial for teachers, as they were easily corrected, can be used to rehearse recommended elements, can help maintain student interest in their learning, and allow teachers to easily check student understanding of concepts.



The most commonly used online assessment practices during the pandemic and the main challenges associated with conducting online assessment.

Recommendation 3: Assessment should be used to determine student progress and develop teaching practices. Consideration of student well-being and giving opportunities for students to practise without being assessed are also important. When assessing online, tools should be chosen based on the subject/specific competence being assessed. Dynamic assessment (e.g., spoken) was found to integrate well with synchronous lessons, while digital media were found to effectively complement asynchronous student assignments. Online quizzes should continue to be used as they are an easy and engaging way to assess learning and their use may help to reduce teacher workload. More research is required to determine the best practice for conducting standardised assessments online.

Finding 4: Approaches to peer collaboration

Online learning approaches that facilitated peer collaboration reported largely positive effects. Teachers used live synchronous lessons for inquiry-based group work, experiments, and to allow

students to revise their work with live feedback from peers. Many studies reported facilitating discussion between students, and it was found that encouraging students to respond to the questions or work of peers alleviated pressure from teachers and encouraged social interaction. Some teachers prioritised social engagement before learning goals due to students' limited social interaction during the pandemic. A common theme emerging from the evidence was that effective peer collaboration was dependent on individual teacher's innovativeness, skills and choice of technologies to implement group work and interactions.



The top collaborative methods that reported positive effects and the main challenges associated with facilitating peer collaboration online.

Recommendation 4: Opportunities for peer collaboration are vitally important when learning online during a pandemic with social distancing. Peer-peer interaction can instil a sense of social presence and inclusion, and is critical for student engagement. Interaction can be synchronous and asynchronous, but synchronous lessons may be more useful for teachers making a shift into emergency remote teaching and for students who did not actively choose asynchronous remote education. However, the choice of technology and tasks must be well designed to facilitate the right type of constructive peer interaction and prevent disengagement through distraction.

Finding 5: Parent engagement

Teachers communicated with parents through WhatsApp or by email and phone, directly or through the school LMS. In remote areas, lacking infrastructure and facilities to provide remote learning, parents collected lesson materials from schools and delivered their children's assignments. Students welcomed their parents' help with online learning and cited the importance of parents for securing access to online resources, providing a suitable home-learning environment, reducing household chores and providing emotional support. Not surprisingly, the shift to emergency remote learning, coupled with parents working from home, had varying effects on family relations. There are a few reported instances in which parents did not support distance learning and a small number of students felt their parents lacked the knowledge to support them with online learning.

WHAT WORKED WELL?	ENGAGEMENT CHALLENGES
<ul style="list-style-type: none"> ✓ Parental involvement and support contributed to student learning ✓ Students recognised their family's efforts ✓ Assisting in live lessons for SEND students ✓ Increased levels of involvement and engagement in learning 	<ul style="list-style-type: none"> ☹ Some families did not encourage students to attend live lessons ☹ Inequalities in access to remote learning ☹ Increased demands on girls at home ☹ Some parents lacked content knowledge or technological skills to be able to help ☹ Some teachers did not contact families

The benefits of parental engagement in online learning and the major challenges associated with poor consideration for parental engagement.

Recommendation 5: Increased parental engagement is seen as a positive outcome of the pandemic. Two-way communication between the school and parents may help to prevent barriers to learning. For example, teachers should be made aware of any issues with access to technology/suitable study space, so learning activities can be designed accordingly. The benefits of online learning should also be communicated to parents. More research into the impact of online learning in vulnerable students is essential to ensure that no students are left behind.

Conclusions

This review synthesised 81 studies on emergency remote education in secondary schools during the COVID-19 pandemic, focusing in particular on student engagement, online assessment, peer collaboration, and parent engagement. Student engagement was facilitated by varied, interactive and synchronous learning experiences, with well-designed opportunities to collaborate with peers. Online formative assessments, such as quizzes, were useful for rapidly judging understanding and gauging engagement. However, adapting standardised assessment for the online setting was challenging. Parent engagement was critical; however, social inequalities affected the capacity of some parents to provide materials and a suitable study space for their children. Consideration for students' means (availability of technology, devices, internet quota) and capabilities (availability of support at home, digital skills, motivation) and well-being, is therefore vital for online and blended learning. Aside from the varied digital infrastructure available and the quality, accessibility and usability of digital technologies and resources, a noteworthy number of articles reported that teacher confidence and digital skills determined whether they designed online learning activities that enabled peer interaction and collaboration. Thus, in order to support effective online learning, targeted professional development, clear guidelines, accessible high-quality technology and the development of a contingency plan to ensure high-quality education in times of crisis are critical for students, schools and teachers.

Background

The COVID-19 pandemic and the resulting restrictions on social contact, triggered a rapid shift to emergency remote education in secondary schools around the world. The Organisation for Economic Co-operation and Development (OECD) estimated that school closures occurred in 188 countries, which impacted the education of over 1.7 billion children and their families (OECD, 2020a). Students, teachers and parents were forced to adapt and innovate to continue teaching and learning remotely, primarily using online learning¹. While many school systems already had online learning tools in place prior to the pandemic, others had to adopt tools and techniques on an *ad hoc* basis, with limited training, preparation or infrastructure in place (Li & Lalani, 2020; Jelińska & Paradowski, 2021; Thurab-Nkholi *et al.*, 2021).

As a result of the unprecedented emergency situation, systemic issues of equity, access and quality became apparent, in addition to disparities in student digital skills and teacher technological pedagogical knowledge (OECD, 2020b; POST 2021). Existing and emerging evidence of online or blended learning² identifies motivation, engagement and enabling constructive peer collaboration as specific challenges for this learning mode in secondary school students (Bergdahl *et al.*, 2020; Bond, 2020a). Yet, well-designed online learning that supports student motivation, engagement and peer interaction is associated with improved academic outcomes (Education Endowment Foundation, 2020; Ofsted, 2021). The positive impact of parental engagement in their children's learning was already well-established (Education Endowment Foundation, 2019); however, the circumstances arising during the COVID-19 pandemic meant that parents and caregivers became essential for supporting their children's online learning. The loss of in-person teacher and peer support resulted in parent's assuming the role of teacher, which may have caused increased strain on family relationships (Russell *et al.*, 2020). Parents also became responsible for resolving technology issues, despite evidence that many parents may lack the digital skills needed to help (ONS, 2019; Onyema *et al.*, 2020).

Finally, the pivot to remote online learning created significant issues with assessing learning, particularly with adapting standardised assessments for the online setting. In many countries examinations were cancelled, provoking chaos and confusion for older secondary school students. Where attempts were made to carry out assessment online, concerns emerged relating to cheating due to the difficulty in controlling the online environment and invigilating remotely.

Despite these challenges, the extended period of online learning has also highlighted a number of potential benefits of this style of learning. For instance, the forced shift to online learning has driven innovation and led to, what some may call, a long overdue modernisation and digitisation of education systems. Many stakeholders in the education sector believe that the changes to education provoked by the COVID-19 pandemic are likely to have a lasting impact on teaching and learning going forward (Li & Lalani, 2020; Schwartz *et al.*, 2020). While secondary schools are expected to return to in-person learning as COVID-19 restrictions ease around the world, the sector is unlikely to 'return to normal' and some online learning approaches and technologies are anticipated to be carried forward.

1 Online learning is learning that takes place in an online environment through the use of internet connected devices. This may be in a *synchronous* 'live' or asynchronous classroom where students can interact with teachers and peers and participation in learning does not depend on physical co-location (Singh & Thurman, 2019).

2 Blended learning is a broad term to describe modes of delivery that combine elements of in-person instruction with online learning activities (QAA, 2020).

Therefore, it is timely to review the evidence gathered to date to learn what worked well during the extended period of online learning and what could be taken forward.

Rationale for the review

This systematic review aims to summarise the published research evidence on online learning during the period of school closures during the COVID-19 pandemic. It also aims to gain insights into how the period of emergency remote education was experienced by secondary school students, their parents and teachers globally. In particular, the review focuses on topics of interest that were raised during stakeholder discussions at an IPPO Roundtable event 'Online education: what will we take forward from the pandemic?' namely: how online learning affected student motivation and engagement and were there emerging online assessment practices, approaches to peer collaboration and parent engagement.

The review is the first systematic summary of evidence of an extended period of online and blended learning in secondary schooling, aside from rapid reviews (e.g., Bond, 2020b), as evidence collected prior to the pandemic is typically from short-term periods of online learning. The review also considers the key challenges and opportunities for this mode of learning and describes the variety of approaches taken by countries around the world. The review also seeks to identify which online learning approaches could be taken forward by secondary schools, either in the context of building resilience to future crises or for integration into regular education programmes. It is hoped that this review can help to inform future decisions relating to policy and practice for online and remote learning and identify knowledge gaps where further research is necessary.

Positionality

This review builds on the experience of the authors in conducting thorough evidence syntheses on online and blended learning both prior to and during the COVID-19 pandemic (Bergdahl et al., 2020; Bond, 2020a; Bond, 2020b; Bond & Bergdahl, 2021). The work follows on from a previous evidence snapshot summarising the emergency remote education situation in schools during the COVID-19 pandemic (Bond & Bolan, 2021). It also builds on the findings of a recent UK parliamentary briefing, written in consultation with, and peer-reviewed by key stakeholders in the field of online and distance learning (POST, 2021).

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Objectives

In order to explore how blended and online learning occurred in secondary schools during the COVID-19 pandemic, a systematic review was undertaken using explicit and transparent methods, with studies included for synthesis based on predetermined criteria (Gough et al., 2012; Zawacki-Richter et al., 2020), and following the PRISMA reporting guidelines as closely as possible (Page et al., 2021).

In order to determine the research questions guiding the review, an IPPO roundtable event was held in April 2021 with key stakeholders (teachers, school leaders, education department representatives from the four UK nations, policy makers and researchers). Following a discussion of key issues and experiences during the pandemic, and drawing on an evidence snapshot (Bond & Bolan, 2021), five key research questions emerged:

1. How did emergency remote education affect motivation and engagement in secondary students?
2. How did research report on emerging online assessment practices in secondary schooling during the pandemic?
3. Are new approaches to peer collaboration emerging and what does this suggest?
4. How did online learning in secondary schools affect parent engagement?
5. What emerging uses of online and blended learning approaches in secondary schools could continue to be implemented going forward?

Method

Search strategy and selection procedure

The initial search was conducted on 5 May 2021 and closely followed the strategy of a previous rapid systematic review (Bond, 2020b) undertaken by the first author that identified studies undertaken

during the pandemic at both primary and secondary school levels. Due to time constraints, a decision was made to focus the scope of the review solely on secondary education (Years 7-13), and to include only English language publications. The platforms and databases searched were Scopus, Web of Science, ERIC, and Microsoft Academic Graph, which are considered well-suited to evidence synthesis (Chen, 2020; Gusenbauer & Haddaway, 2020), alongside the COVID-19 living systematic map (Shemilt et al., 2021). A smaller number of studies were also found manually (referred to as ‘manual searching’ in the PRISMA diagram, see Figure 1), within the COVID-19 ResearchGate community³, from Web of Science email alerts, through Twitter, or through peer recommendations (see Appendix E). Given the rapidly changing research landscape during the COVID-19 pandemic, as well as the lengthy peer review process, this method of searching grey literature (including pre-print servers) is recommended for COVID-19 reviews (Tricco et al., 2020). All items from the previously undertaken rapid review (Bond, 2020b), as well as from the living version of that review (Bond, 2021), were also included for consideration.

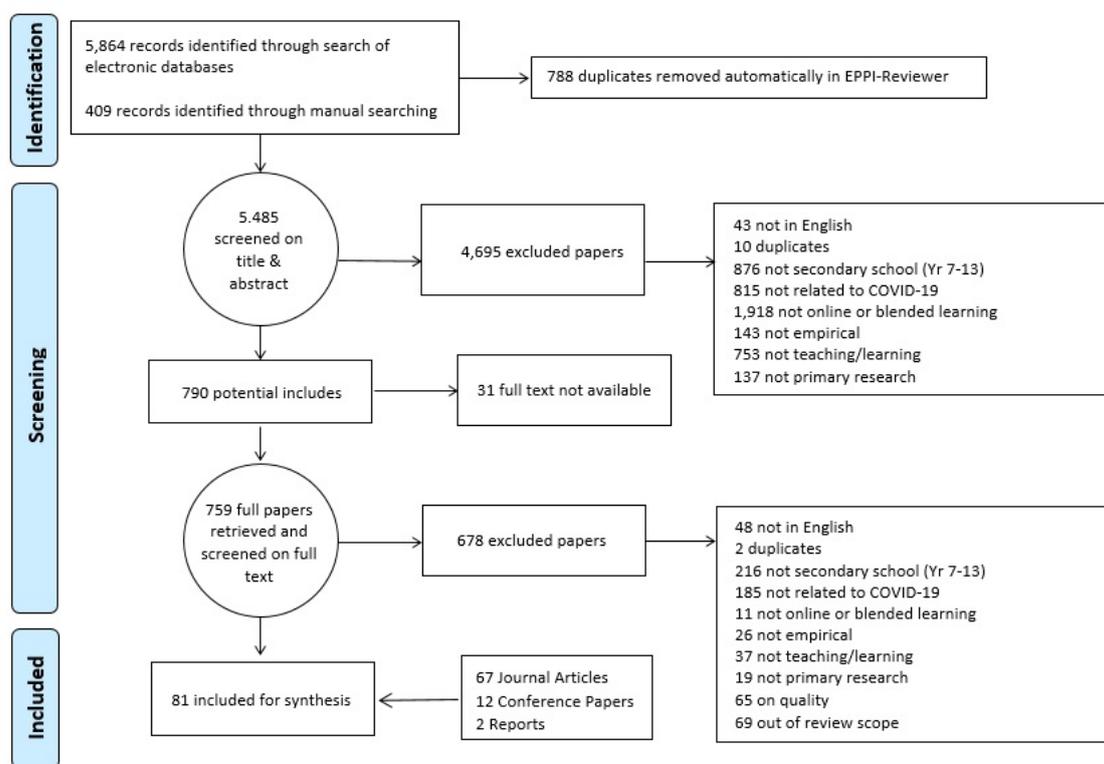


Figure 1. PRISMA diagram

Search string

The search string (see Table 1) was adapted from Bond (2020b) and focused on formal teaching and learning within secondary schooling (Years 7-13) during the COVID-19 pandemic (after January 2020), using * for truncations. Search terms relating to primary school were included at this stage as some countries offer Year 7 in primary school as opposed to high school. Due to the large number of Coronavirus-related medical studies that have been published during the pandemic (see Shemilt et al., 2021), medical terms such as ‘public health’ and ‘surgery’ were added as NOT terms in order to further refine the search results.

³ <https://www.researchgate.net/community/COVID-19>

Table 1. Search string

“emergency remote teaching” OR “student-centred remote teaching” OR “emergency remote education” OR “student-centered remote teaching” OR “online pivot” OR “blended learning” OR “online learning” OR “hybrid learning” OR “remote education” OR “remote learning” OR “distance learning” OR “digital learning” OR “eLearning” OR “e-Learning” OR “crisis prompted distance education” OR “home learning” OR “homeschooling” OR “flipped learning” OR “flipped classroom” OR “distance education” OR “online education”

AND

“K-12” OR “primary school” OR “middle school” OR “secondary school” OR school OR “high school” OR “R-12” OR “elementary school” OR “upper primary” OR “senior school”

NOT

“public health” OR non pharmaceutical OR energy OR pharmaceutical OR pharmacy OR clinic* OR pathology OR telemedicine OR inflammation OR patient* OR neurology* OR telehealth OR surgery OR university* OR “higher education” OR postgrad* OR undergrad* OR “tertiary education” OR college

Inclusion/exclusion criteria

The combined search strategy yielded 6,274 records (see Fig. 1), which were imported into the evidence synthesis software EPPI-Reviewer (Thomas et al., 2020). Following the automatic removal of 786 duplicated items, 5,488 items were screened on title and abstract by the review team, applying the inclusion/exclusion criteria listed in Table 2. Studies were included if they were empirical, focused on teaching and learning within secondary schools (Years 7-13) using blended or online approaches during the COVID-19 pandemic, and written in English.

Table 2. Review inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Secondary schooling (Year 7-13)	Pre-school, primary school, higher education, further education
Teaching and learning focus	No teaching and learning focus (focus on policy, adaptations in structural support, leader decisions)
English language	Not in English
Empirical study	Not empirical or primary research
Studies undertaken during the COVID-19 pandemic	Studies undertaken before the outbreak of COVID-19
Studies published after January 2020	Published before 2020
Online or blended learning	Solely face-to-face (in-person) learning

All authors independently screened 100 items for inclusion or exclusion on title and abstract and subsequently met to clarify ambiguity. All authors then screened an additional 50 items and met to discuss any disagreements and to consolidate the inclusion and exclusion criteria. After the initial screen and author discussions, the interrater reliability for the second round of coding of 50 articles was 0.73 (calculated using Cohen’s Kappa, Cohen, 1960), which demonstrates good agreement

between the seven members of the review team. 790 items were included on title and abstract, however 31 items could not be located despite attempts to contact the study authors via email or ResearchGate. 759 items were then screened on full text, applying the inclusion/exclusion criteria, resulting in 129 studies progressing to the data extraction and quality appraisal phase. A full list of the inclusion/exclusion decisions for all items considered in the review can be found on the [review website](#).

Data extraction

The coding systems used in Bond (2020a) and Bond (2020b) were adapted for this review, to extract data within EPPI-Reviewer. Data extraction codes included publication type, methodology (e.g., date of data collection, method), setting/context (e.g., country, continent), population (e.g., number of participants, participant focus), intervention (e.g., specific pedagogical approaches), and outcomes (based on the bioecological model of student engagement by Bond & Bedenlier, 2019; and Bond 2020a). Student engagement in this review was understood as:

“...the energy and effort that students employ within their learning community, observable via any number of behavioural, cognitive or affective indicators across a continuum. It is shaped by a range of structural and internal influences, including the complex interplay of relationships, learning activities and the learning environment. The more students are engaged and empowered within their learning community, the more likely they are to channel that energy back into their learning, leading to a range of short- and long-term outcomes, that can likewise further fuel engagement.” (Bond et al., 2020b, p. 3)

Specific examples of student engagement and/or disengagement were coded using multiple indicators of behavioural, cognitive and affective (dis-)engagement (see Bond, 2020a), as well as social disengagement (see Bergdahl et al., 2020). Technology used was also coded at both the individual tool and category levels, as used by Bond (2020b), based on Bower’s (2016) typology (see Appendix C). A full list of the coding scheme can be found in Appendix A.

Quality appraisal

During the screening and data extraction process, the authors considered the quality of the studies. Owing to the difference in maturity and self-regulation of students in secondary as opposed to primary school, any studies that mixed results from the two levels were excluded. Any studies that did not provide a clear and detailed description of the methodology were also excluded. A formal quality assessment was then conducted (see Appendix D), based on the process used by the EPPI-Centre (Moss et al., 2021). The quality assessment was designed to answer two questions:

1. Does this study answer our research questions?
2. Is the evidence trustworthy, given the methods used, results and conclusion?

Studies that were given a decision of ‘partly’ for either question were reviewed by an additional team member to determine whether the study was suitable for inclusion. At the end of the quality appraisal process 81 studies were included in the evidence synthesis. A full list of the quality appraisal decisions for each item can be found on the [review website](#).

Data synthesis

A narrative synthesis of the data was undertaken (Petticrew & Roberts, 2006), including a tabulation of the studies and their characteristics (see Appendix B). Further tables are located throughout the text or included as appendices to clearly summarise the review findings. These are accompanied by a narrative description summarising the results.

Interactive evidence gap maps

In order to provide a publicly accessible overview of the studies within this review, interactive evidence gap maps were produced for each research question, using the EPPI-Mapper application (Digital Solution Foundry & EPPI-Centre, 2020). Following the data extraction in EPPI-Reviewer, a JSON report of all 81 studies was imported into EPPI-Mapper, where filter and display options were chosen⁴. The HTML files of each map were saved and are available to access from the [EPPI-Centre website](#). These maps allow users to explore cross tabulations of data within the review, allowing deeper insights into the data than can be provided in this report. Users can also download the studies as a RIS file (and import it into their own reference management software).

Web database of included studies

To further assist the education community, an [openly accessible database](#) of the included studies and their associated coding was made using the EPPI-Visualiser tool within EPPI-Reviewer⁵. This database allows users to search for specific studies, run frequency and cross-tabulation reports, create bar and pie charts, see publications by year of publication, and see the full coding record of each study (see Fig. 3).

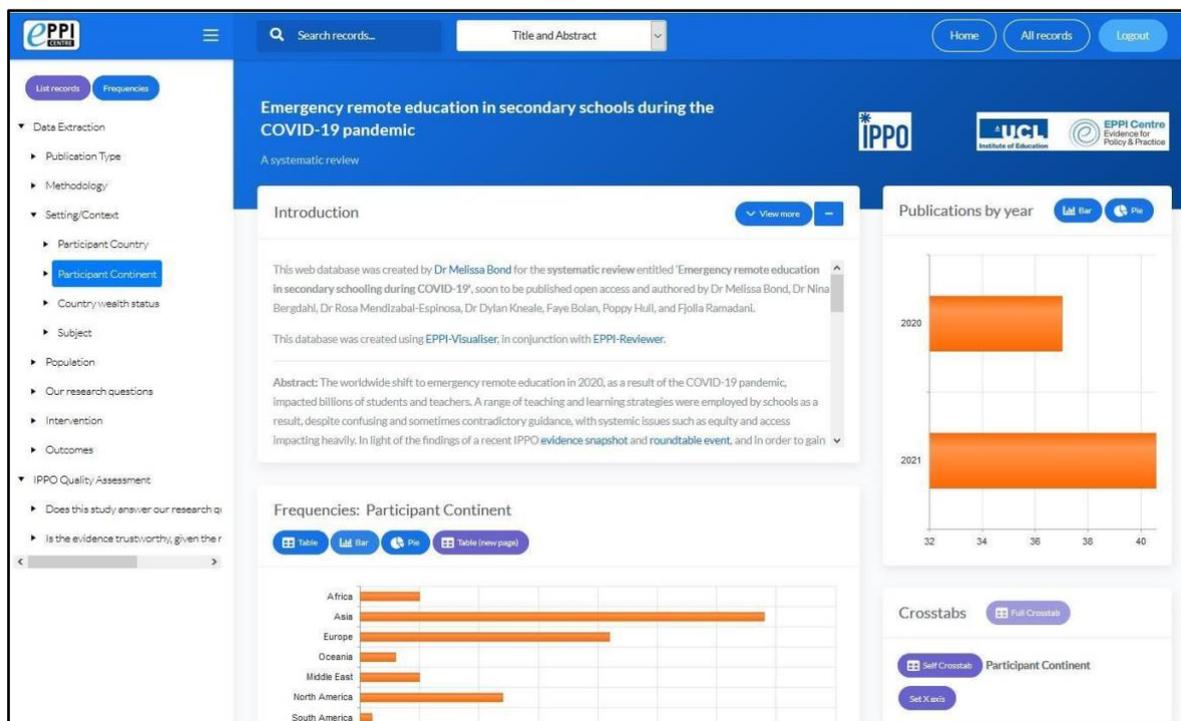


Figure 3. [Web database](#) of included studies

Further stakeholder involvement

Preliminary findings were presented to the participants of a second IPPO stakeholder roundtable event in July 2021. This included an executive summary of the evidence, as well as a summary document. Stakeholders were then given the opportunity to respond to the evidence during the roundtable, helping to refine the final report.

4 For more information about EPPI-Mapper and creating interactive evidence gap maps, see <https://eppi.ioe.ac.uk/cms/Default.aspx?tabid=3790>

5 See <https://youtu.be/bhQuGpeB2Lo> for an informal introduction to using EPPI-Visualiser

Additional considerations

The studies in the review were coded on indicators of cognitive, affective, behavioural and social (dis-)engagement, alongside (de-)motivation (Appendix A), following the model of student engagement by Bond & Bedenlier (2019) and the instrument developed by Bergdahl et al. (2020). Research publications often conceptualise engagement differently (as previously noted: Alrashidi, et al. 2016; Henrie, et al 2015). The authors used the indicators of engagement as described in the studies. It should also be noted that the presence of an engagement indicator in a certain percentage of studies does not mean that the rest of the studies reported the opposite; merely that this is the proportion of studies where particular indicators were specifically mentioned (see Bond, 2020a; Bond et al., 2020).

While online ethics, digital privacy and data security are important considerations in online education, Bergdahl and Nouri (2020) found that these aspects were initially neglected when teaching moved online at the beginning of the pandemic. Although they are outside the scope of this review, they have been covered elsewhere (e.g., Stewart & Lyons, 2021). Another important aspect relates to the difference between perceived and actual learning. The studies included in this review have findings that reflect both learning gains and losses, as well as how experiences of teaching and learning were reported by teachers, students and parents. Here, the review focused on exploring how schools and teachers implemented formal learning and how this was perceived.

Findings

Overview of the included studies

The studies in this review were predominantly journal articles ($n = 67$, 83%), as well as 12 conference papers and two reports.

Study characteristics

Geographical characteristics

The research synthesised in this review was undertaken in 38 different countries (see Appendix F), across all continents (Asia 42% studies, Europe 26%, North America 15%, Africa 6%, Middle East 6%, Oceania 4%, South and Central America 1%). Most studies were conducted in Indonesia (23%, $n = 19$), followed by the United States (14%, $n = 11$), China (5%, $n = 4$), and Slovakia, Austria and Hong Kong (4%, $n = 3$, each). According to the World Bank country wealth status⁶, 2% of studies were from low-income countries, 35% from lower-middle income countries, 9% from upper-middle income countries, and 54% from high-income countries (see Figure 4).

⁶ [WDI - The World by Income and Region \(worldbank.org\)](https://data.worldbank.org/indicator/YY.NY.GDVS)

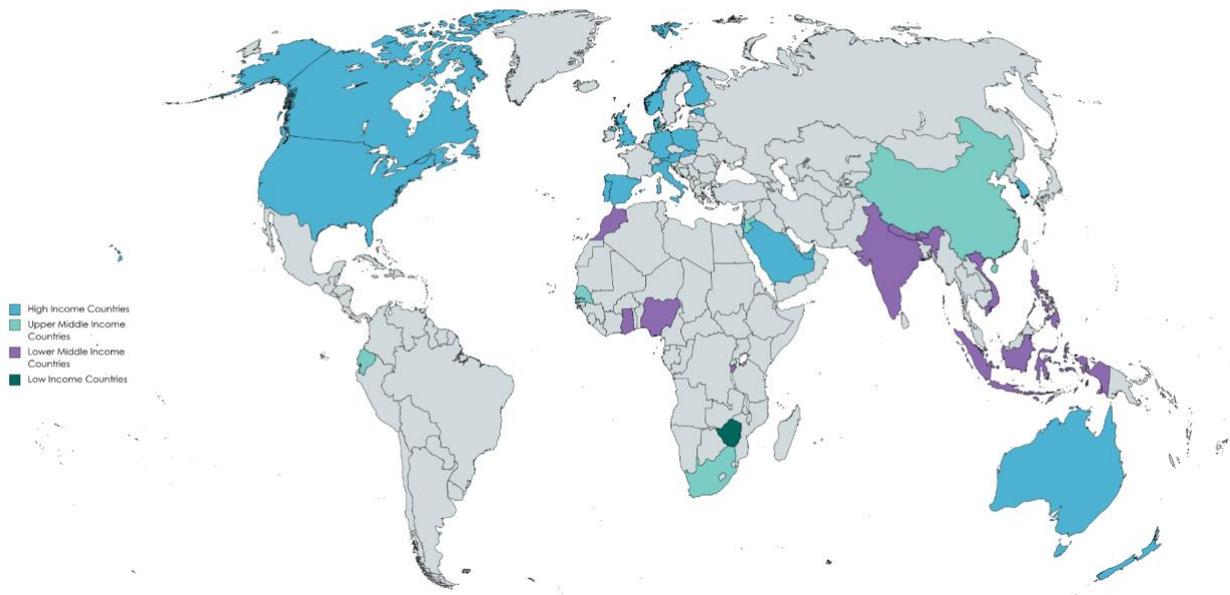


Figure 4. Countries in the review by World Bank wealth status

Sample focus

Most of the evidence came from students (64%, $n = 52$ studies), followed by teachers (53%), parents (6%) and school leaders (5%), although some studies did not specify whether their teacher respondents were also part of the school leadership team (see Appendix G). Very few studies triangulated data from multiple sources; for example, one study interviewed students, parents and teachers on the use of Google Classroom and television lessons (Dorji, 2021); one study explored student, teacher and school leader perceptions (Niemi & Kousa, 2020); and one study conducted focus groups with teachers, students, parents and school leaders (Education Scotland, 2021). As has been highlighted previously (Bond, 2020b), this is likely due to research manageability and access to participants during the pandemic. However, collecting data from multiple sources has been noted as a priority focus for future research (Kim & Asbury, 2020; Primdahl et al., 2020).

Few studies focused specifically on vulnerable students, with one study exploring the experiences of migrants and refugees (Primdahl et al., 2020), one study focusing on students with lower levels of Maths attainment (Hodgen et al., 2021), and seven studies specifically reporting on students from lower socio-economic backgrounds. Five studies explicitly included evidence about students with special educational needs and disabilities (SEND). For instance, Becker et al. (2020) explored the experiences of students with Attention-Deficit/Hyperactivity Disorder, and four other studies included students with a range of profiles from Indonesia (Balkist & Agustiani, 2020), Spain (Álvarez-Guerrero et al., 2021), Scotland (Education Scotland, 2021), and Germany (Nusser, 2021). Of the 52 studies with students as participants, only 40% ($n = 21$) reported which school year students were in (see Figure 5). This revealed that studies focused predominantly on senior secondary year levels, with participants from years 10 and 11 included most frequently (16% of studies). This was in contrast to pre-pandemic research into flipped learning (Bond, 2020a), which focused primarily on middle year secondary students.

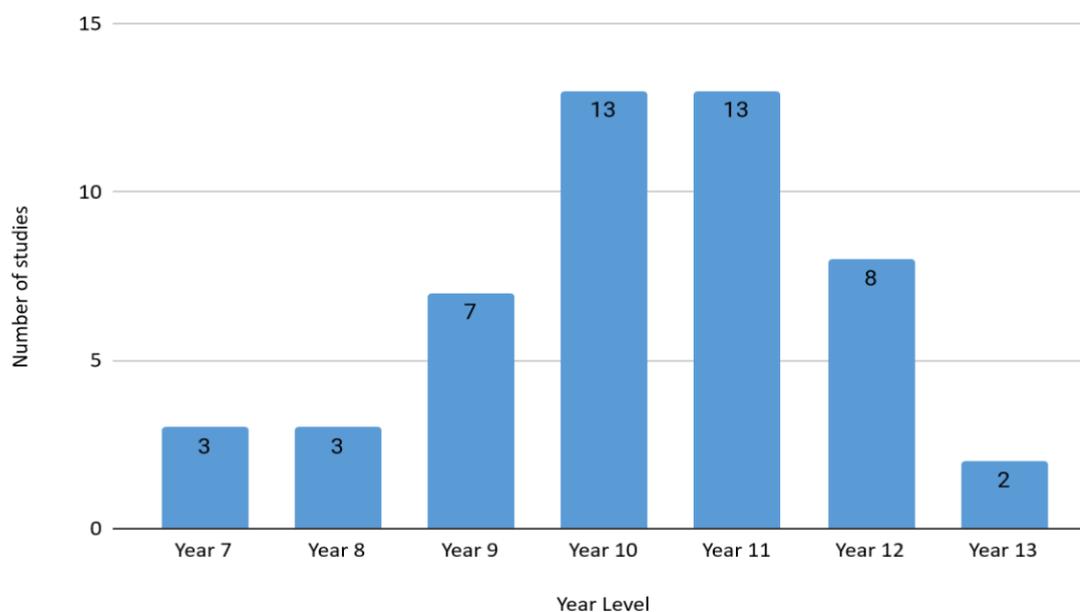


Figure 5. Year levels represented

40% of studies ($n = 32$) classified their respondents by gender, including three studies with female only respondents (Oraif & Elyas, 2021; Schaefer et al., 2020; Sibanda & Mathwasa, 2021). The studies were also categorised according to sample size (see Appendix I). 18.5% of studies had more than 400 participants, with three European studies having over 2,000, from Slovakia (Velichová et al., 2020), Poland (Korzycka et al., 2021), and Austria (Pelikan et al., 2021). 33% of studies ($n = 27$) had between one and 25 participants, which represents a higher percentage of smaller scale studies than in higher education research (16%, Bond et al., 2021). Three studies did not report the exact number of participants involved (Education Scotland, 2021; Okebukola et al., 2020; Rusmansyah et al., 2021).

Education setting

19 studies (23%) identified the type of school that the research took place in. Nine studies indicated that respondents were from a government funded/public school, eight studies indicated that their respondents attended both government and private schools, and one study reported that respondents attended a private/independent school only. Specific subjects were mentioned in just over half of the studies ($n = 44$, see Appendix H), where English as a Second or Foreign Language ($n = 14$, 17%) was the most frequently researched individual subject, followed by Maths ($n = 11$) and Chemistry ($n = 8$). However, in accordance with previous research on online and blended learning in schools, both prior to (Bond, 2020a; Lo et al., 2017; Lundin et al., 2018) and during the pandemic (Bond, 2020b), STEM (science, technology, engineering and medicine) subjects were overall the most researched (28% of studies).

Methodological characteristics

The majority of studies were qualitative (47%, $n = 38$), 35% were quantitative ($n = 28$) and 18% used mixed methods ($n = 15$). Given the emergency circumstances in which the research took place, it is unsurprising that 65% of studies used an online survey ($n = 53$) for data collection (Appendix J), followed by interviews (41%, $n = 33$). Given the varying severity of the COVID-19 pandemic throughout 2020-2021, it is important to consider *when* data were collected (Figure 6). The majority of studies that reported when data was collected, conducted their data collection in March (16%), April (25%),

May (26%) and June (16%) of 2020 (Figure 6), although 45 studies (56%) did not report when data were collected.

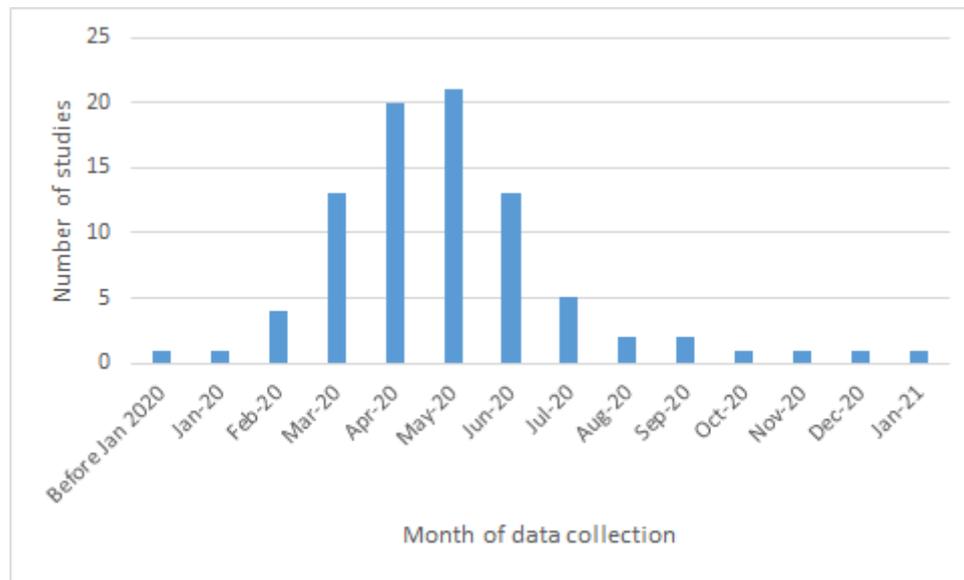


Figure 6. Timeline of data collection

Technology used for remote teaching and learning

The most frequently used technology tools in the studies in this review (Appendix K) were *synchronous collaboration tools* (58%, e.g., live video lessons), *knowledge organisation & sharing tools* (46%, e.g., Learning Management Systems such as Google Classroom), *text-based tools* (43%, e.g., WhatsApp messages, email), and *multimodal production tools* (38%, e.g., recorded videos). Interestingly, the use of *synchronous collaboration* and *multimodal production tools* increased by 10% from a previous review of 89 studies undertaken during the pandemic (Bond, 2020b). This is in accordance with findings from the UK that secondary school students received more live lessons than primary school students (Bond & Bergdahl, 2021). Also of note was the increased number of studies reporting the use of live video lessons in high-income countries (70%) as opposed to lower middle-income countries (39%). Conversely, a higher number of lower middle-income countries (54%) and low-income countries (100%, two studies) reported using *text-based tools such as WhatsApp*, compared to upper middle (43%) and high-income countries (34%). A reason for these findings may be related to national differences in digital infrastructure (bandwidth) and accessibility to digital devices.

Research question 1: In what ways did emergency remote education affect motivation and engagement in secondary school students?

Given the enormity of the shift to emergency remote education and the multiple negative impacts of the pandemic on all aspects of everyday life, it is interesting to find that almost the same number of studies reported incidences of engagement and/or increased motivation (80%, $n = 65$) as the number of studies that reported incidences of disengagement and/or demotivation (81%, $n = 66$). The most frequently reported dimension of engagement (although arguably the most apparent and therefore easiest to measure) was behavioural engagement (56% studies, $n = 45$), followed by cognitive engagement (53%) and affective engagement (48%). Twenty studies (25%) mentioned aspects from all three dimensions of engagement and 20% of studies ($n = 16$) cited examples of positive or increased

student motivation. The six most frequently stated indicators of engagement were *self-regulation, understanding, positive study habits, enjoyment, sense of wellbeing* and *participation/involvement* (Table 3).

Behavioural engagement

Twelve indicators of behavioural engagement were identified, with improved *study habits* the most cited (17%, $n = 14$). Some students enjoyed the freedom of being given all their work for the week on Monday and being able to set their own timetable. This was also positively perceived by parents, who were often responsible for supporting multiple children alongside their own work (Education Scotland, 2021). Some students also took the initiative to search for additional learning materials (Shidiq et al., 2021; Weinhandl et al., 2021) or to replay videos or audio files of conversations or feedback (Simanjuntak et al., 2021; Tong & Wang, 2020). Such behaviours had been noted as a benefit of the flipped learning approach prior to the pandemic (Bond, 2020a).

Active *participation/involvement* was reported in 13 studies (16%), with some studies stating that live synchronous lessons were more effective at encouraging participation than providing recorded videos and self-study materials alone (Aldossry, 2021), as students and teachers had a stronger sense of connection (Bruin, 2020). UK school leaders in Mathematics (Hodgen et al., 2020) found that online remote learning was particularly beneficial for students, who were previously reticent to answer questions in the classroom. Teachers in Sweden (Willermark, 2021) also found that there was improved attendance by students who usually did not attend school, as there was no pressure to be physically present. In cases where low participation in online classes was an issue, students still reported feeling more *responsible* for completing homework tasks (Velichová et al., 2020). Accordingly, 12% of studies mentioned that online learning helped to boost students' learning independence (e.g., Nawawi et al., 2021).

Table 3. Top five indicators of engagement across the three dimensions

Behavioural Engagement			Cognitive Engagement			Affective Engagement		
Indicator	%	N	Indicator	%	N	Indicator	%	N
Study habits	17%	14	Self-regulation	26%	21	Enjoyment	16%	13
Participation/involvement	16%	13	Understanding	19%	15	Sense of wellbeing	15%	12
Assuming responsibility	12%	10	Critical thinking	10%	8	Positive interactions with peers	15%	12
Time on task	11%	9	Focus/concentration	10%	8	Interest	12%	10
Confidence	9%	7	Positive self-perceptions	7%	6	Positive attitude towards learning	11%	9

Cognitive engagement

Linked to *study habits* and *assuming responsibility* is students' increased *self-regulation*, indicated in 26% of studies ($n = 21$). In a Vietnamese study, Tran et al. (2020) found that students who were intrinsically motivated and believed that "self-learning was necessary because it maintained their learning habits" (p. 12), studied approximately 40 minutes more a day than their classmates. However, Hodgen et al. (2020) found that students who could self-regulate their learning were often high-attainers, who already had those skills prior to the pandemic. Yet there were examples of students exhibiting greater ownership of their learning and developing a new sense of independence during

school closures (e.g., Chiu, 2021; Hira & Anderson, 2021). One teacher in a US study (Kaden, 2020) speculated that the reason that some students thrived was due to reduced distractions, such as bullying and socialisation issues.

Students' deepened *understanding* was cited in a number of studies and related to subject content (e.g., Nugraha et al., 2021) and their ability to discuss and communicate topics effectively (e.g., Bruin, 2020). Characteristic approaches of online learning also helped increase understanding (Nurliani et al., 2021; Poláková & Klímová, 2021), such as the use of videos (e.g., Rusmansyah et al., 2021) and flipped feedback (e.g., Education Scotland, 2021). In a study of Maths students in the United Arab Emirates, Almarashdi and Jarrah (2021) found that students were focused more on developing their understanding of concepts, rather than on memorising answers for tests during remote online learning.

Affective engagement

Students expressed *enjoyment* of online learning in 16% of studies for a variety of reasons. Chemistry students (Babincakova & Bernard, 2020) enjoyed conducting experiments at home using everyday materials, alongside receiving "interesting videos and interactive homework" (p. 3298). Whereas other students enjoyed making their own videos (Chiu, 2021), learning independently (Pelikan et al., 2021) and at their own pace (Kaden, 2020) and using technology that they normally would not (Amelia et al., 2020). Some students also felt a heightened *sense of wellbeing* as a result of learning from home (e.g., Babincakova & Bernard, 2020), as they found it to be more comfortable and less stressful, although this was not the case for all students (see section on disengagement below). Asanov et al. (2021) found that students from wealthier households, with stable internet connection and educated parents, were more likely to report being happy and feeling less anxiety related to completing homework (Ferraro et al., 2020). Interaction with teachers and peers was mentioned frequently as being important for student wellbeing (e.g., Yates et al., 2020), with some studies even reporting improved social skills since the beginning of remote learning (e.g., Álvarez-Guerrero et al., 2021).

Motivation and learning gains

In a large New Zealand study (Yates et al., 2020), students found that teachers who: checked in with them via email or phone, gave timely feedback, used collaborative tools, made expectations clear and provided differentiated resources, were particularly motivating. Students were also motivated by being allowed to use technology that they normally would not be, for example the use of mobile phones in science lessons to measure sound levels (Baptista et al., 2020) and the use of gamified apps such as Kahoot! (Cheung, 2021). Providing students with opportunities to problem solve, both alone and with peers, also positively affected student motivation (e.g., Weinhandl et al., 2021), with some teachers commenting that a portion of their students appeared to be more motivated during the school closures than usual (e.g., Niemi & Kousa, 2020). Students in a Vietnamese study (Tran et al., 2020) who were intrinsically motivated to learn were found to study longer than those who were extrinsically motivated (e.g., by parents, teachers, friends).

Learning gains were reported in 18 studies (22%), although it was widely acknowledged by many teachers that assessing students accurately during the pandemic was difficult (e.g., Niemi & Kousa, 2021). Kelley (2020) found that students who chose to undertake experiments at home earned comparable grades to average semester lab grades. In addition, Indonesian students found that their anxiety was reduced when undertaking exams from home, as there was less perceived pressure without the exam hall situation (Suliani et al., 2021). Another reported benefit of conducting online learning activities during the pandemic was the development of students' digital competencies (Baptista et al., 2020; Chiu, 2021). However, Hu and Huang's (2021) study of Year 10 students in

Australia stressed the importance of appropriate curriculum design, including providing materials in multiple ways (e.g., on- and offline resources) and in multiple digital places.

Challenges: Disengagement and demotivation

Examples and forms of disengagement identified

Billions of children were at risk of experiencing disengagement from learning during the transition to remote online learning, due to factors such as the (un)suitability of home environments for learning, potential losses in learning and cancelled assessments, experiencing poorer health and well-being at home (e.g., increased anxiety) and lower levels of social interaction with teachers and peers that are conducive to learning. Among the studies included in the review, over three quarters ($n = 66$, 81%) reported some form of disengagement in the form of cognitive, affective, behavioural or social disengagement (Table 4). However, many studies also reported positive forms of engagement and over half of studies reported aspects of both positive engagement and disengagement ($n = 52$, 64%).

Table 4. Top five indicators of disengagement

Behavioural Disengagement			Cognitive Disengagement			Affective Disengagement			Social Disengagement		
Indicator	%	N	Indicator	%	N	Indicator	%	N	Indicator	%	N
Absence	19%	15	Confusion	19%	15	Overwhelmed	14%	11	Social isolation	27%	22
Poor conduct	9%	7	Distracted	11%	9	Dislike	14%	11	Reduced interaction with teachers	12%	10
Task incompleteness	9%	7	Unfocused/inattentive	9%	7	Dissatisfaction	11%	9			
Half-hearted	7%	6	Unwilling	6%	5	Worry/anxiety	11%	9			
Giving up	6%	5	Pressured/stressed	6%	5	Boredom	10%	8			

Affective disengagement

Affective disengagement, characterised by a negative emotional response to online learning among students, was reported in almost half of studies ($n = 37$, 46%), with students feeling overwhelmed, dissatisfied, worried and anxious, or bored with online learning. The most commonly occurring form of affective disengagement was students feeling *overwhelmed* (11 studies, 14%), including feeling overburdened with the volume of online learning and homework. A Slovakian student characterised these feelings of being overwhelmed, saying “At our school, we learn from 8 am to 1 pm. It’s not that bad, but we also have a lot of homework so I have to learn non-stop. I think it’s too much and tiring and stressful” (Babinčáková & Bernard, 2020, p. 4). In some cases, feelings of being overwhelmed were in turn accompanied by feelings of boredom, anxiety or dislike of school/learning. For example, in one study students reported feeling overwhelmed with the barrage of assignments that felt insurmountable, while being confined to a restrictive home learning environment, which heightened feelings of frustration and boredom (Schaefer et al., 2020).

Behavioural disengagement

Behavioural disengagement reflects the observable negative actions of students, such as being absent from learning, giving up on tasks, non-participation and being unprepared for learning. Over two-fifths

of studies reported behavioural disengagement among students ($n = 36$, 44%), with *absence* being the most common expression of behavioural disengagement ($n = 15$, 19%). In some cases, issues with technology, such as problems with connectivity, were found to impact student attendance (e.g., Okebukola et al., 2020). In some other cases teachers and parents stated that students clicked on links to participate in live lessons but then became distracted with other activities (e.g., Bhattarai, 2020). In some studies teachers also reported low levels of engagement online, i.e., that students were shy about being on camera or being recorded (e.g., Bruin, 2020). Although technology and connection issues are predicted to be a greater barrier to engagement in lower income countries, studies conducted in high-income countries were more likely to report issues with student absence. More broadly, instances of behavioural disengagement were more frequently reported in studies from higher income countries (26/44 studies, 59%) than those conducted in low- and middle-income countries (10/37 studies, 27%). In a small number of studies, behavioural disengagement manifested in more intractable forms, such as the four studies reporting students feeling burnt out and exhausted.

Cognitive disengagement

Students who are cognitively disengaged are those who are detached from the learning environment, which manifested in the evidence as students becoming distracted, unfocused, feeling stressed or pressured, feeling apathetic or helpless or becoming oppositional or unwilling to learn. Over a third of studies reported students becoming cognitively disengaged ($n = 30$ studies, 37%), which was most commonly associated with students being 'confused' and having problems understanding or following lesson content ($n = 15$, 19%). In some cases, failing to keep up with lesson content was thought to be particularly challenging for more technical subjects (Dema et al., 2021). In an autoethnographic study, 'confusion' was attributed to a feeling of constant change, where students "felt 'more or less [like] an experiment [in which] things are changing very quickly.' The day is no longer 'set in stone'; rather, class time is fluid: time expands and contracts as needed." (Schaefer et al., 2020, p10). The impact of vague and contradictory directives from government ministries was also forwarded as exacerbating feelings of confusion among students (Weinhandl et al., 2021).

Social disengagement

Social disengagement – disengagement, isolation and poorer quality interactions and relationships with peers and teachers - was mentioned in a third of studies ($n = 26$, 32%). Over a quarter of all studies indicated social isolation ($n = 22$, 27%), and 12% ($n = 10$ studies) described decreased student-teacher interactions. Among those studies that measured social isolation quantitatively, it reached high levels with 73% of students expressing feelings of isolation in online learning in a study of students in India (Bhaumik & Priyadishini, 2020). 96.5% of students in a Polish secondary school study cited a lack of contact with teachers and peers (Kochan, 2021). A number of studies described the perception of teachers that students were missing out on being part of a school community. For example, they had lost the "rounded classroom atmosphere" (Gordy et al., 2021, p. 4) or were described as missing out on the social connections needed to complete their work (Hira & Anderson, 2021). Social disengagement was reported more frequently in studies conducted in high-income countries (17/44 studies, 39%) than those conducted in low- and middle-income countries (9/37 studies, 24%).

Lower motivation and learning loss

A consequence of higher levels of disengagement was that students had lower levels of overall motivation (reported in 16 studies, 20%) and lower motivation was identified as being particularly problematic among lower achieving students in some studies (Nusser, 2021; Mælan et al., 2021; Pelikan et al., 2021). Although the explanations put forward for lower motivation among students were diffuse, a number of studies attributed issues with technology and internet connection as

explanatory factors (Al Salman et al., 2021; Dema et al., 2021; Hodgen et al., 2020). Meanwhile, students in another study were observed to have lower levels of motivation as a result of broader uncertainty and concerns about the 'state of the world' (Yates et al., 2020) and a small number of studies also attributed lower levels of motivation to home environments that were not conducive to learning where other roles and duties that children have (e.g., caring for siblings, helping with family businesses) may have taken precedence (Azhari & Fajri, 2020; Sibanda & Mathwasa, 2021; Yates et al., 2020).

In a number of studies, the cumulative impacts of low motivation and various forms of disengagement translated into a loss of learning (reported in 18 studies, 22%). A study by Code et al. (2020) documented the perspectives of teachers who were concerned that an online format only allowed for certain parts of the curriculum to be taught: "For the most part, we are not able to teach the most important parts of the curriculum. We can teach theory, or use online simulations for some subjects, but the hands-on skills are lost" (p. 7). There was also concern that learning loss was not experienced evenly across the student body, and that female learners were particularly susceptible to losses in some contexts because of caring duties (Sibanda & Mathwasa, 2021). However, while concerns about lost learning were raised in a number of studies, others highlighted the difficulty in accurately assessing students' real learning (e.g., Niemi & Kousa, 2021; see also section on assessment).

Gender implications

Five studies found no significant difference in the experience of students based on gender: in Jordan (Al Salman et al., 2021), Italy (Ferraro et al., 2020; Pirrone et al., 2021), Poland (Korzycka et al., 2021), and Vietnam (Tran et al., 2020). Although in Korzycka et al.'s (2021) study, girls were significantly more likely than boys to have an issue with the requirements of home schooling (59.6% vs. 53.2%; $p=0.001$). In an Ecuadorian study, Asanov et al. (2021) found that females were more likely to be responsible for household tasks, but that they were 5% more likely to have engaged in online learning. In addition, females were more likely than their male counterparts to do school work into the late afternoon. Sibanda and Mathwasa (2021) also found that female learners in Zimbabwe experienced particular difficulties in accessing online learning due to household chores, internet access, issues of abuse and distraction. In their study of 324 students using the Metacognitive Questionnaire on Study Method, Pirrone et al. (2021) explored differences in learning strategies, metacognition and study, and attitudes towards traditional in-person schooling and online learning. They found that females performed significantly better than males in all three areas during in-person learning, but that the differences were eliminated as a result of the pandemic. One study of SEND students in Germany (Nusser, 2021) found that home schooling was more challenging for parents if their child was male.

School status implications

When school status is considered in relation to engagement and disengagement (see Table 5), instances of behavioural engagement were higher and social disengagement were lower where both private schools and government schools were included in a study, compared to studies including only government schools. However, affective engagement was higher in government schools, and incidences of both affective and behavioural disengagement were higher in studies of both private and government schools. In a study of 420 Vietnamese students, Tran et al. (2020) found that students attending private school spent more time on school work during the pandemic than those in government schools (4.0 hours compared to 3.4 hours on average).

Table 5. School status and student (dis-)engagement

	Both government & private schools		Government schools only	
Cognitive engagement	5	63%	5	56%
Affective engagement	3	38%	5	56%
Behavioural engagement	7	88%	4	44%
Cognitive disengagement	3	38%	4	44%
Affective disengagement	5	63%	3	33%
Behavioural disengagement	6	75%	5	56%
Social disengagement	2	25%	4	44%

Engagement, disengagement and technology

In order to understand how the various technology types used during emergency remote learning are linked to engagement, a co-occurrence analysis was undertaken between technology and instances of overall behavioural, cognitive and affective engagement (Table 6). The analysis revealed that the types of technology tools with the highest incidences of reporting engagement were *assessment tools* (e.g., online quizzes or polling such as Kahoot!), *knowledge organisation & sharing tools* (e.g., Learning Management Systems, LMS), *social networking tools* (e.g., Facebook), *social collaborative tools* (e.g., live video lessons) and *multimodal production tools* (e.g., recorded videos).

Overall, few studies that employed video conferencing reported aspects of student disengagement, with (approximately) one-in-ten or fewer of the 46 studies using video conferencing reporting on aspects of student disengagement (behavioural, affective, cognitive or social). In contrast, reports of student disengagement were more common in studies that reported learning taking place through videos produced by teachers, video materials produced by other sources, or Google Classroom. For example, among the 24 studies where learning took place through Google Classroom, between two-fifths and half of studies reported instances of behavioural disengagement ($n = 11$, 46%), affective disengagement ($n = 9$, 38%), cognitive disengagement ($n = 12$, 50%) or social disengagement ($n = 10$, 42%). Similarly, although only a fifth of studies overall reported low motivation ($n = 16$, 20%), this was higher among studies using Google Classroom ($n = 8$, 33%). Similar distinctions were observed in studies using teacher-produced videos and videos from other sources, as well as studies reporting using WhatsApp for online learning. However, such differences should be interpreted with caution, given that reports of disengagement were often also accompanied by reports of positive engagement. Furthermore, the depth of evidence to support these numbers differed across and within studies. Nevertheless, overall, it was observed that studies using YouTube ($n = 14$) reported behavioural engagement most frequently relative to disengagement (8 vs 4 studies) and the same was true for affective engagement (8 vs 3 studies). Meanwhile, studies using teacher created videos ($n = 18$) reported cognitive engagement vs. disengagement more frequently (9 vs 6 studies). Overall, the quality of evidence and the instances of engagement and disengagement occurring within the same study, makes it difficult to identify any one form of technology over another as having a harmful impact in terms of disengagement. While the findings relating to specific tools are interesting and may stimulate further enquiry, their scope is limited to descriptive purposes only.

The role of online assessment tools on student engagement

Studies that used online assessment tools, such as quizzes or polling software (e.g., Kahoot!), indicated a heightened level of both affective and behavioural engagement (71%, $n = 10$). In particular, they were found to assist students' study habits, helping them to assume responsibility for their learning by promoting reflection and confidence (Education Scotland, 2021). Students particularly enjoyed the gamification element of apps such as Kahoot! (e.g., Yates et al., 2020). Online assessment tools will be discussed in greater detail under research question two below.

Table 6. Relative frequency of studies using technology types and student engagement

	SCT	MPT	SNT	KOS	TBT	AT	LG	WCT	DAT	VW
	$n = 47$	$n = 31$	$n = 8$	$n = 37$	$n = 35$	$n = 15$	$n = 2$	$n = 1$	$n = 1$	$n = 1$
Cognitive Engagement	53%	55%	50%	54%	43%	47%	50%	100%	100%	100%
Affective Engagement	55%	55%	63%	51%	46%	67%	100%	100%	100%	0%
Behavioural Engagement	62%	58%	63%	62%	51%	67%	100%	100%	100%	100%

Note: SCT = Social collaborative tools, MPT = Multimodal production tools, SNT = Social networking tools, KOS = Knowledge organisation & sharing tools, AT = Assessment tools, LG = Learning games, WCT = Website creation tools, DAT = Data analytics tools, VW = Virtual worlds

The role of Learning Management Systems on student engagement

Many schools were able to turn to the use of Learning Management Systems (LMS) quickly, given the large number of secondary schools who already had them in place (Bond, 2020b). The effective use of LMS was linked to students developing better study habits and self-regulation skills. Students reported feeling a heightened sense of control over their own learning when activities were self-paced (Chiu, 2021), as well as feeling more motivated and supported by their teachers (Yates et al., 2020). Google Classroom was the most used named platform (30% studies) and it was found particularly useful due to its accessibility (Atmojo, 2020) and the ability to post assignments, share videos and provide feedback (e.g., Rusmansyah, 2021). LMS that featured collaborative tools, such as Google Classroom, promoted a sense of wellbeing and positive interactions with peers, over those platforms without such tools, which was in agreement with a previous pre-pandemic review (e.g., Bond, 2020a).

The role of social networking tools on student engagement

Social media was used by teachers as a way to communicate with students and parents, using technology that they generally already had access to and were comfortable with using. For example, one teacher used Snapchat in their class and reported that it was the most successful tool for reaching and engaging learners (Primdahl et al., 2020). A STEM activity from a Portuguese study (Baptista et al., 2020) involved students conducting inquiry-based investigations into the noise level where they lived, and in creating posters and videos for people in their local area about the health effects of noise pollution. The posters and videos were then disseminated on social networks, such as Facebook and the school's website, which raised the interest level and the authenticity of the task for students. Parents also assisted with creating the videos, which enhanced the experience greatly for students. In a study by Langansan (2020), social media helped break down barriers between teachers, students and parents, as the teacher created Facebook groups for each class, creating announcements of work due and had group chats for teachers and parents to keep lines of communication open. However, despite the reported benefits of using Facebook Live for conducting synchronous lessons, adequate

internet connectivity was an issue in some cases (e.g., Chirinda et al., 2021) and many teachers opted for WhatsApp⁷ instead (Lawrence & Fakuade, 2021).

The role of live synchronous lessons on student engagement

Live lessons (e.g., through Teams or Google Meet) were by far the most mentioned learning tool (57% of studies). In studies where synchronous live video lessons were used, instances of engagement were found in more than double the number of studies than instances of disengagement. The use of breakout rooms for students to work together in groups was particularly engaging (Education Scotland, 2021) and interactive approaches for social online meetings, such as scavenger hunts and trivia were particularly popular (Easterly et al., 2021). Allowing students to use the chat function within live lessons also promoted peer interaction and peer teaching (Hodgen et al., 2020), as did providing social time at the beginning and end of lessons for students to catch up with each other in a more informal setting (Lepp et al., 2021).

The role of recorded videos on student engagement

Videos made by those other than their teachers resulted in higher levels of behavioural and affective engagement in students (83%, as opposed to 50% for videos made by teachers), including heightened interest (33%) and enjoyment (17%). However, videos made by teachers were more likely to be mentioned alongside a sense of wellbeing (28% over 17%), understanding (22% over 17%) and study habits (33%).

Research question 2: How did research report on emerging online assessment practices in secondary schooling during the pandemic?

The shift to online learning meant that traditional forms of assessment, such as controlled pen and paper tests in the classroom, had to be adapted for the remote setting. Of the studies included in this review, the most frequently reported assessment types were online quizzes ($n = 13$, 16%) and formative online feedback ($n = 13$, 16%), followed by online conversations or speaking assessments ($n = 6$, 7%), images $n = 5$, 6%) and online exams ($n = 4$, 5%).

Exploring the results further, we found that most studies mentioned one type of assessment; although, a recent report of Scottish schools (Education Scotland, 2021) mentioned at least nine different types of assessment. Overall, we identified 21 types of online assessment tool. Less common types included checklists ($n = 3$, 4%), self-assessment ($n = 6$, 7%), peer assessment ($n = 3$, 4%), ePortfolios ($n = 3$, 4%), projects ($n = 2$, 2%), reflective learning journals ($n = 2$, 2%), and videos ($n = 2$, 2%). Other assessment types included at home experiments (Babinčáková & Bernard, 2020), choose your own adventure (students can choose their own learning path) (Lepp et al., 2021), online debates (Yan, 2021), and research projects (Schaefer et al., 2020).

Online quizzes

Many studies reported using online quizzes, citing that they were easy to correct (Aldossry, 2021), could be used to rehearse recommended elements (Hodgen et al., 2020), “reduce student boredom in online learning” (Suliani et al., 2021, p. 2), allow students to learn at their own pace, reduce stress during testing (Velichová et al., 2020), and allow teachers to gain insight into student learning

⁷ It should be noted here, however, that WhatsApp was coded under Text-based Tools, and not under Social Networking Tools or Synchronous Collaboration Tools.

processes. Some teachers chose to use the built-in quiz feature in the school LMS (Aldossry, 2021) or they created their own using Google Forms (Amelia et al., 2020; Atmojo & Nugroho, 2020; Cheung, 2021; Rahayu & Wirza, 2020). Several studies conducted online quizzes through Kahoot (e.g., Education Scotland, 2021; Kaden, 2020; Velichová et al., 2020) and commented on the perceived usefulness of the gamification aspects (Yates et al., 2020). For example, "Through their responses in the Kahoot! game, I can see what mistakes they are making and how much they can understand." (Cheung, 2021, p. 9).

Formative online feedback

To ensure students were provided with timely feedback on their work, several studies reported a use of built-in LMS features to provide written or recorded responses (e.g., Aldossry, 2021; Kaden, 2020), or used communication applications such as WhatsApp (Budianto & Arifani, 2021; Okebukola et al., 2020). For example, one study used Formative, which was "incorporated into the course's technology portfolio at the start of remote learning for submission of all previously 'hard-copy' assignments (lab packets, quizzes, tests)" (Kelley, 2020, p. 2).

Engaging in synchronous online learning was identified as a means to provide formative feedback in real-time, where regular learning activities such as presentations, writing, debates and role-plays provided opportunities for dynamic assessment (Hu & Huang, 2021), as well as a place for teachers to directly praise students (Rusmansyah et al., 2021). In addition, the use of "the chat panel during live learning to ask and answer questions" and the "use of emojis and symbol responses" (Education Scotland, 2021, p4) were used for formative assessment, with more informal feedback using the 'thumbs up' or 'hands up' features helping to gain a snapshot of student engagement and progress.

Receiving adequate feedback from teachers was a concern raised by both student and parent participants in several studies. One study suggested that teachers had been advised to be less strict during the pandemic and to provide formative feedback instead of focusing on assessing grades (Lepp et al., 2021). One student lamented:

"Teachers ask for homework, make us send it, I spend all day doing the homework, send it to them, and they don't give me my grade, I think they don't check the homework, they just check if somebody sent them, and if not, they give them a bad mark ('1') with no chance for improvement" (Korzycka et al., 2021, p 6).

A number of studies also found that teachers struggled to provide formative feedback during online learning and in some cases were unsure if their students were learning, which highlights the impact of the loss of immediate feedback and communication in the online environment (e.g., Cheung, 2021). Hodgen et al (2020) noted that "46% of schools provided comments on pupils' work less frequently" and that "teachers expressed frustration about providing formative feedback due to lack of live interaction with pupils". Classroom interactions online can be characterised by teacher efforts to help students achieve learning objectives and gauge actual progress, while trying to overcome the hindrances of students' passive participation and tendency to follow "a modelled explanation of how to do something" (Hodgen et al., 2020, p 21). When teachers cannot identify if their students are actively learning, this may impede feedback and be a barrier to effective learning (Cheung, 2021; Hodgen et al., 2020).

Online conversations or speaking assessments

Some studies commented on the usefulness of conversation as a method of assessment, particularly for modern languages (Education Scotland, 2021; Yan, 2021). Students recorded themselves speaking

or listened to recordings of their teacher speaking, in order to improve pronunciation (Hu & Huang, 2021). Similar methods were used for Drama performances and to rehearse dialogues and presentations (Education Scotland, 2021). In other subjects, personal conversations with students were found to be a powerful way for teachers to informally check student understanding (Chirinda et al., 2021; Kaden, 2020).

Images

Lepp et al. (2021) pointed out that teachers often offered a range of ways to submit homework, including using images, submitted through the school LMS or in hard copy. Images could be sent either by emailing photos of their work (Kochan, 2021; Lepp et al., 2021), or using tools such as Flipgrid (Kaden, 2020). Some teachers asked students to prove that they had completed the task by taking photos, such as when carrying out lab experiments and cooking tasks at home (Easterly et al., 2021; Education Scotland, 2021). One example included students taking pictures of food nutrition labels; to ensure that students had actually done the work themselves rather than finding the photos online, teachers asked students to be in the photo as well (Easterly et al., 2021).

Online exams

Two studies found that most students were examined online during the period of remote learning (e.g., Kochan, 2021). Bhaumik and Priyadishini (2020) found that a slight majority of the students (52.7%) felt “ease in appearing for online exams after gaining familiarity with online learning” (p. 9) and concluded that as online learning becomes more familiar to students, so will online exams. Other studies (Budianto & Arifani, 2021; Willermark, 2021) reported that teachers found it hard to manage cheating in the online setting, which demonstrates the limited readiness of many schools for the online shift. Willermark (2021) added that school leaders had become aware of the extent to which teachers relied on examinations for grading in traditional learning and expressed that exams “have received too much focus among teachers” and that “teachers should become better at trusting their own judgment, [particularly, with students they have taught for many years]” (p. 14).

When assessment did not work

It should be noted that some studies commented that teachers felt they lacked “knowledge on how to conduct tests efficiently and quickly, and with good quality” (Rap et al., 2020) and that some education departments and institutions decided to cancel assessments (e.g., Hodgen et al., 2020) and halt grading (Easterly et al., 2021). Another reason assessments were delayed was because government policies prohibited or restricted such online practice. For example, Rap et al. (2020) reported that at-home chemistry experiments were not permitted for many Israeli teachers due to legal restrictions. Interestingly, in Ghana, online learning was not permitted at all and in Morocco and Senegal all assessments were suspended. Later in the pandemic, the Ghanaian government began to consider using online assessment (Okebukola et al., 2020). In South Korea, The Ministry of Education instructed schools to halt all assessments until they could be done in person in the classroom (Jeong & So, 2020).

Research question 3: Are new approaches to peer collaboration emerging and what does this suggest?

This review also focused on peer collaboration which had previously been identified as an aspect of online learning which is challenging for teachers to facilitate (Bergdahl & Nouri, 2020). The association between constructive, well-designed peer collaboration and improved learning outcomes is well-established for secondary school students. The loss of in-person peer support during the remote learning period forced schools to create new methods of online peer collaboration. These new

methods included redesigning existing learning activities for an online mode, combining digital devices to allow for peer collaboration and an increased focus on the social aspects of engagement. While there were several instances of creative practices, emerging challenges were also identified and are discussed below.

Learning activities in an online mode

As previously discussed, several studies were of live classes using applications that support (synchronous) communication, such as Google Meet, MS Teams and Zoom (e.g., Aldossry, 2021; Baptista et al., 2020; Bhaumik & Priyadishini, 2020; Kaden, 2020; Turchi et al., 2020). Within these applications breakout rooms were used to undertake inquiry-based group work (Baptista et al., 2020), work on experiments (Kelley, 2020), develop interactive ePortfolios (Weinhandl et al., 2021), conduct online debates (Yan, 2021), assess work with peers (Education Scotland, 2021), or revise and edit work (Turchi et al., 2020). Several studies highlighted a particular focus on student discussions; for example, by building on literature and using 'Dialogic Literary Gatherings' to listen and learn from each other online (Álvarez-Guerrero et al., 2020) or by the teacher choosing discussion topics that encouraged social engagement (Chirinda et al., 2021). The increased focus on student social interaction was likely a deliberate effort by teachers to counteract the social isolation students faced during the pandemic.

While online peer collaboration was primarily facilitated through video conferencing systems (Google Meet, MS Teams and Zoom), some alternative methods emerged, such as: involving students in an online group campaign and using social media production, where students co-created digital posters and videos that were distributed online to the local community (Baptista et al., 2020), using discussion boards to facilitate one-to-one sharing of ideas and conduct school work with peers (Turchi et al., 2020), or developing and testing a new LMS to support teaching/learning and interaction (Aldossry, 2021; Oraif & Elyas, 2021). One study pointed out that peer interactions were dependent on teacher innovativeness (Chirinda et al., 2021). While new approaches were identified, some approaches remained traditional; for example, the comment feature and/or 'suggesting mode' in Google applications enabled a simple form of peer feedback and collaboration (Yan, 2021). Using Google applications for learning may be considered traditional, as Google documents have been used for peer collaboration in classrooms for more than a decade (e.g., Kittle & Hicks, 2009; Rienzo & Han, 2009; Rhine & Bailey, 2008). However, it may have been perceived as new if students had not used this tool from home before (Chiu, 2021).

Several studies reported that other applications such as Facetime (Weinhandl et al., 2021, Yates et al., 2021) were used to support peer collaboration. The use of WhatsApp as an educational tool yielded mixed results, with some studies citing problems when using the application as the primary education tool (e.g., Agustin Mawarni et al., 2020; Budianto & Arifani, 2021; Chirinda et al., 2021). Another study referred to WhatsApp as 'the most liked' application (Nawawi et al., 2021). The mixed responses may reflect the variety of ways the tool was implemented for different purposes and the degree to which the technology was aligned with a pedagogical approach.

How practical, aesthetic and theoretical subjects combine modalities to support peer collaboration

Practical and aesthetic subjects may be viewed as subjects that, perhaps more than the theoretical ones, are dependent on non-verbal communication and embodied modelling⁸ (e.g., Hira & Anderson,

⁸ The teacher uses body language to communicate and model exercises and actions.

2021). Among the studies there were examples of teachers who used multiple devices that enabled students to learn choreographed sections from each other in dance classes: “the dance class used Google Meet, which allowed for students to teach each other choreographed sections and work independently in virtual studios. /.../ Moreover, while trying to teach a new dance, both a computer and phone were used to communicate through Google Meet and play music on” (Yan, 2021, p. X). In music classes, it was reported that students would regularly need to combine devices to enable peer interaction; for example, their instrument and at least one application for communication. Music educators noted an improvement in the way students shared their ideas and took part in online ensemble groups compared to traditional learning (Bruin, 2020). In more theoretical classes, examples of peer collaboration included using chat messaging during synchronous classes. One teacher stated: “so pupils will make comments. Other pupils will respond from that and then you will get a series of inter-connected responses, so I'm just sitting back, watching the chat take place whilst they're talking to each other and helping to answer each other's questions” (Hodgen, 2020, p 21).

Social presence to support social engagement

A significant number of studies mentioned that students longed for social interaction and that their social needs were not met during the pandemic (e.g., Almarashdi & Jarrah, 2021; Jayathirtha et al., 2020). One study found that support for social engagement was critical (Yates et al., 2021) and suggested that some students might attend online classes just to see their classmates (Easterly et al., 2021). Some teachers reported prioritising social engagement with peers before learning goals (Lepp et al., 2021). In some cases, both teachers and students took the initiative to form groups that could work together (synchronously and asynchronously) (Turchi et al., 2020) and plan mutual activities to take place after the pandemic, which was found to strengthen the social structure (Weinhandl et al., 2021) and respect (Álvarez-Guerrero et al., 2020) between the students. A notable number of studies reported that students felt that they were ‘together’ when meeting online (Álvarez-Guerrero et al., 2020; Nawawi et al., 2021; Weinhandl et al., 2021) and that digital technologies in fact supported better peer-peer communication (Nawawi et al., 2021). However, Yates et al. (2020) noted that fewer than 10% of the students reported that online collaboration was better than in-person interaction.

Importantly, several studies highlight that not all students are comfortable with the social arena that school provides (Lepp et al., 2021). One study commented that students, when they were allowed to, preferred working individually at their own pace (Turchi et al., 2020). However, not all synchronous communication applications were effective at supporting peer collaboration in all situations. While some studies showed that a majority of students reported ‘getting ample opportunity’ to interact (e.g., Bhaumik & Priyadishini, 2020), studies more frequently pointed out that peer interactions were dependent on the individual teacher’s innovativeness (Agustin Mawarni et al., 2020; Bruin, 2020; Chirinda et al., 2021) and actual skills to implement effective interaction and group work (Primdahl et al., 2020; Niemi & Kousa, 2020). Therefore, it appears as though the quality of communication and peer interaction depends on teacher insights, skills, available technologies, choice of technologies, and crucially, whether the chosen technology is accessible by all students. However, the idea that remote learning may lead students to want self-paced and individual work, focusing more on individual student progress and task completion (Turchi et al., 2020), may be in opposition to purposeful peer collaboration. Another interpretation may be that not all students were equally comfortable with online interaction (Bhaumik & Priyadishini 2020; Willermark, 2021; Yan, 2021) or that students were unhappy with how the teacher orchestrated online collaboration (Yates et al.,

2021). Some studies identified teachers who acknowledged students' different preferences and provided opportunities for peer collaboration for those who wanted it (Lepp et al., 2021).

Synchronous interaction emerging norm in distance teaching and learning

Findings reveal emerging practices to enhance peer collaboration in online teaching and learning in secondary schools. Some reports concluded that synchronous learning methods were optimal as they encouraged "participation and interaction with the teacher to a far greater degree than recorded study or online self-study" (Aldossry, 2021, p. 5) and that learners reported benefits from peer interaction (Hodgen et al., 2020) and appreciated synchronous interaction (Education Scotland, 2021). One study reported that when offered both synchronous (e.g., Meet, Teams, Zoom) and asynchronous (e.g., a forum) teaching and learning, students would ignore the asynchronous resource and only attend synchronous classes (Aldossry, 2021). Another study stated that peer collaboration is critical for supporting students from diverse backgrounds, where the time between peer or teacher interaction, if not synchronous, should be minimised (Jayathirtha et al., 2020). The findings reveal that many teachers struggled with enabling peer collaboration in the online setting (e.g., Hodgen et al., 2020; Jayathirtha et al., 2020; Rap et al., 2020). One study stated that nearly half of the teachers in one study did not make any effort to enable students' collaboration (Rap et al., 2020). Another study found that "there were few (if any) opportunities for peers to see each other's work or to learn from and support each other, which was a core pedagogical practice used across many e-textile teachers" (Jayathirtha et al., 2020, p. 7) and that "almost none of the schools facilitated live interactions between pupils, with many citing safeguarding concerns rather than technical issues" (Hodgen et al., 2020, p. 21). One study reported that nearly 40% of the students experienced challenges when seeking to interact with peers (Agustin Mawarni et al., 2020). Several studies reported on hesitancy amongst teachers to facilitate peer-collaboration which may reflect the limited training and the uncertainty surrounding the speed with which many tools were adopted.

Research question 4: How did online learning in secondary schools affect parent engagement?

Parental engagement with their child's online learning was perceived as highly important in the studies in this review. A large study in Nigeria found that parental involvement improved students' commitment to online learning (Lawrence & Fakuade, 2021). Another relatively large Indonesian study found that parental involvement in learning was significantly increased during the remote learning period (Zakso & Agung, 2021) and a group of Portuguese teachers regarded increased parental involvement as one benefit of the pandemic (Baptista et al., 2020).

Students welcomed their parents' help with online learning (Álvarez-Guerrero, 2021; Ang & Wu, 2021; Kochan, 2021; Trung et al., 2020; Zakso & Agung, 2021,). They highlighted the importance of their parents for securing access to online resources, providing a suitable home-learning environment, reducing household chores and for supporting them emotionally (Kochan, 2021). Parents also provided guidance and supervision (Álvarez-Guerrero 2021; Ang & Wu, 2021; Kochan, 2021; Nusser, 2021), which students found helpful for enhancing their understanding of the subject matter (Kochan, 2021). Parental support with online learning was especially important when students were required to produce visual material, such as videos (Baptista et al., 2020). A Vietnamese study found that family support was a key extrinsic motivation factor that influenced students' learning effectiveness (Tran et al., 2020).

Unfortunately, not all parents had the financial resources to give their children sufficient access to online learning (Sibanda & Mathwasa, 2021; Okebukola et al., 2020). In addition, students were encouraged to make use of their parents' electronic devices, which may have been used by multiple children or needed by parents for their own work, and guidelines were developed to help parents set up parental controls (Okebukola et al., 2020). In remote areas lacking infrastructure and facilities to provide remote learning, parents collected lesson materials from schools and delivered their children's assignments in-person (Azhari & Fajri, 2021).

Teachers communicated with parents through WhatsApp (Okebukola et al., 2021), by phone and text messages (Azhari & Fajri, 2021), or by email and phone (Clausen et al., 2020) both directly and using the school LMS (Clausen et al., 2020; Okebukola et al., 2021). Teachers sometimes contacted parents to explain the rules of online sessions (Okebukola et al., 2020), to follow up on student progress (Azhari & Fajri, 2021) and to check on students who were absent (Bhattarai, 2020).

This review found that parent-teacher communication was most affected in lower middle-income areas. Several Indonesian schools contacted parents through a "teacher-on-duty" in school. In some African countries, literate parents were encouraged to open email accounts for themselves and their children to maintain communication with teachers and submit assignments (Okebukola et al., 2020). Yet even in wealthier regions, teachers and schools encountered difficulties trying to reach families; Clausen et al. (2020) found that teachers failed to contact more than half of students (59%) resulting in parents being unaware of their children's assignments.

Two of the 14 studies that analysed different dimensions of parental engagement, looked at the experiences of students with special educational needs and disabilities (SEND). A Spanish study found that parental support during synchronous sessions was crucial for mediating communication between teachers and students in discussions of literary texts in the context of Dialogic Literary Gatherings (DLG) (Álvarez-Guerrero, 2021). Another study found a substantial discrepancy between the time that parents of students with and without SEND spent supporting their children, with parents of students with SEND spending more than twice the amount of time than parents of students without SEND; however, the parents of SEND students rated their perceived ability to support their children more highly (Nusser, 2021).

Examples of little or no support

There are a few reported instances in which parents did not support their children's online learning. For example, some families failed to see the benefits of remote teaching and therefore did not encourage children to join online sessions (Bhattarai, 2020). In other cases, inequalities in access to remote learning were aggravated by increased demands on girls to complete household chores or parents fears that they could misuse newly found internet access (Sibanda & Mathwasa, 2021). A small number of students felt their parents lacked the knowledge to support them with their learning (Kochan, 2021). Unsurprisingly, the shift to emergency remote learning, coupled with parents working from home, had varying effects on family relations, both positively and negatively. A study reported that a conservative amount (10.5%) of surveyed students (n=114) did not perceive large alterations in their family dynamics (Kochan, 2021).

Research question 5: What emerging uses of online and blended learning approaches in secondary schools could continue to be implemented going forward?

Equity considerations need to be at the forefront when assessing the potential of online and blended learning

Teaching practices during the pandemic were immensely varied, particularly between high- and low-income countries. Online teaching and learning require a basic level of infrastructure, digital accessibility, usability and digital competence from students, parents and teachers alike. As such, recommending one way forward for online learning globally is problematic and beyond the scope of this review. Nevertheless, many common themes emerged from the diverse literature included in this review, which could help to build a general guide for raising the minimum standards of online learning in the future, helping to identify a set of principles that should be implemented or retained going forward.

Despite assurances that we are ‘all in this together’, the pandemic has not impacted all members of society equally but has in fact exacerbated existing inequalities (Bambra et al 2020). While the unequal impacts of the pandemic have been a focus of a number of studies on health and mental health (although there is still considerable work to be done in these areas), systematic study of educational inequalities are only just beginning to be explored. In this review, we observed that the transition to online learning has disproportionately impacted some groups. In particular, students of lower ability were identified as being more susceptible to some of the negative impacts of online learning, such as low motivation. Similarly, girls’ education was more likely to be disrupted because of caring duties and other pressures, in some contexts. Meanwhile, large numbers of students globally have been disadvantaged by having limited availability to technological equipment, internet connection and a lack of an appropriate working space for online learning. Some authors of studies in this review attributed these challenges as a barrier to students’ motivation. These challenges were foreseeable, although few of the studies described measures taken to ensure equity in access to online learning. In future, it may be advisable to harness teachers’ detailed and personal insights in order to differentiate and individualise content and assessment strategies, to ensure a more equitable approach to online learning for all students.

Engagement and disengagement

New online teaching materials developed during the pandemic should be regarded as a sustainable resource that can be reused and developed further going forward. Several studies reporting instances of positive student engagement where those where online learning took place in the form of teacher-generated videos. Teacher-generated videos enable students to re-watch content, which may represent an opportunity for teachers to reuse the videos and reduce the workload associated with remaking resources each academic year. Teacher-generated videos and online quizzes could be integrated within normal in-person schooling, to consolidate understanding and ensure students have a sustainable workload. However, findings also indicated that some teachers struggled with digital innovation and that the level of teachers’ digital literacy impacted the quality and variety of online learning experiences offered to students. Some studies have pointed out that students experience sore or strained eyes from excessive screen-time. To avoid monotonous teaching practices, ongoing teacher professional development is key. Such professional development should be integrated throughout a teacher’s career, should be updated in line with new technologies and pedagogical

advances and should educate teachers on effective online learning design methods that supports student engagement.

Assessment methods that combine brief and deep insights should be integrated into students' learning

Online quizzes can enhance student understanding, as well as provide teachers with a quick idea of student progress. In contrast, recorded teacher or peer feedback and assessment tasks provide students with opportunities for deeper reflection and improvement. A blend of both types of assessment can help to maintain student engagement and the development of creative and innovative assessments can drive teacher creativity and professional development. However, the evidence in this review also indicated that over-assessment risked overwhelming students and potentially also staff responsible for marking assessments, leading to demotivation. Therefore, the development of new assessments should be planned in tandem with guidelines on how to balance considerations of student wellbeing, tracking students' educational progress and teacher workload and skills.

Opportunities for peer collaboration should be integrated into online learning

Online learning should be designed in a way that supports peer collaboration and robust guidelines need to be developed so some students do not miss out on this important aspect of learning. The variety of examples cited in this review could be used to inform local best practices on peer collaboration, to support schools looking to develop policy to support student social needs outside the classroom and to guide the choice of useful technologies for enabling such policies.

Parental engagement is key to online learning, which opens new ways for teachers to engage with parents

Parental engagement was found to be a key facilitator of successful online learning. Despite secondary school students being on a pathway to becoming independent learners, they still valued parental input in their learning and parents were involved in facilitating online learning in a number of ways from sharing equipment to helping with practical tasks and assignments. The transition to online learning allowed many parents to become involved in their children's education in a much more regular way than prior to the pandemic, which has provided greater opportunity for parents and teachers to communicate and work together to improve students' learning. However, not all parents could or would engage to the same extent, which may deepen inequalities and widen the attainment gap, and some studies noted difficulties in contacting parents. Therefore, schools may need to use alternative forms of communication to reach some parents and families, particularly those who lack access to online technology, and schools may need to create bespoke plans for parents to engage with their children's learning. In addition to communicating the benefits of remote learning to families, teachers and schools may also need to gain a better understanding of home learning environments and the support available at home. This again reflects a need to develop individualised strategies for supporting parents, and in particular parents of students with SEND or students with low attainment, to ensure online learning does not exacerbate educational inequalities.

Discussion and conclusion

Plans for future unscheduled school closures

As a result of the shift towards online teaching and learning, some established and perhaps traditional views of education have been challenged. For instance, the question of how, when, if and to what extent assessments should be conducted, and also how effective communication and socialisation can take place online (i.e., student-student/teacher; student/parent - school/teacher communication). Apart from the varied digital infrastructure and the quality, accessibility and usability of digital technologies and resources, we identified a noteworthy number of articles indicating that teacher digital insecurities determined how well teachers designed online learning activities that enable peer interaction and collaboration. Formative assessment continues to be a reliable way to inform teachers on student progress and develop their (online) practices. While 21 different strategies to assess students online were identified, most teacher, school and even national governments displayed reactivity rather than proactivity to shift to online schooling. Thus, ongoing, integrated and targeted teacher digital professional development, clear school, local authority and government guidelines, accessible high-quality technologies and the development of contingency plans will help build resilience and ensure continuity of high-quality education during times of crisis, and are critical going forward.

Support and social engagement

Student social engagement covers the need to feel supported by teachers and parents, and a feeling of having one's social needs met through collaboration and interaction with peers. As has been presented in this review, much of the research conducted during the period of rapid educational change explored student engagement and related aspects, such as peer collaboration, parent support and assessment. The results show the foci of exploration across studies globally (often expressed in percentages). Informed by previous understanding, these percentages reflect that student engagement in general and social engagement, in particular, are critical. The social restrictions due to school closures and lockdowns have amplified a longing for social inclusion, but despite a handful of positive examples, this review found that students' social needs were often not met. After the first year of the pandemic, innovative approaches are not merely using Google Meet, MS Teams or Zoom for learning, but rather adapting learning designs, combining digital devices (e.g., Yan, 2021) or finding creative ways of using these applications (e.g., Baptista et al, 2020) while striving to create a sense of a social community between teachers and students (e.g., Weinhandl et al, 2021) and creative ways for assessment (Easterly et al., 2021; Education Scotland, 2021). Opportunities for peer collaboration are vitally important when learning online during a pandemic with social distancing. Peer-peer interaction can instil a sense of social presence and inclusion, and is critical for student engagement.

While this report identified increased parental engagement during the pandemic, parental involvement and support with online learning was not common for all. This finding should inform directed interventions to increase parental engagement in case of future pandemics. Results reveal that parents would provide high levels of support, but that social inequalities affected the capacity of some parents to provide materials and a suitable study space for their children. Teachers should be made aware of any issues with access to technology/suitable study space, so learning activities can be designed accordingly. Dietrich et al. (2020) found that receiving support is critical for online learning, as students who do not receive support invest considerably less time and effort than students who receive daily support. In the case of future lockdowns or school closures, schools should prioritise supporting students' social needs, while acknowledging that these may vary between students.

Informing future strategies

In terms of the future of teaching and learning after the pandemic, synchronous in-person instruction seems to be here to stay. Results indicate that the teachers with good technological knowledge and skills pre-pandemic seemed to embrace the online learning switch more seamlessly to facilitate effective learning, collaboration and assessment. Mindful of the changing conditions of today's global society, with pandemics and extreme weather events becoming more common and the emergence of ever more advanced digital capabilities, schools must adapt to digital technologies and develop the digital skills of teachers and students in readiness for the future. In addition, there is a need for parents to be provided with additional support during periods of remote learning. An increased provision of training in using technology for teaching and learning, for both teachers and parents, is highly recommended. Even with such standardised professional development, it is unlikely that we will see balanced progression across all schools. Rather, as is the case currently, some schools will take a lead in their development, which is why best practice guidance within school districts may be beneficial for schools who lack the means or the initiative to innovate. Such guidance should endeavour to address a range of issues including student and teacher workload, tailored advice on planning and teaching online, carrying out online assessment and student and teacher well-being. This should include consideration for teaching and learning activities away from screen, one-to-one time with teachers, alternative routes for teacher-parent communication, progression monitoring and social activities between lessons and after school. The pandemic has exposed a risk of increased discrepancies across teachers and schools. There is more appetite and motivation in some regions for schools and teachers to embrace the changes and capture the momentum to provide effective, sustainable teaching and learning online. More research is needed to inform stakeholders of the implications of reduced social presence with online teaching and learning and the effect on young students' social-emotional development.

Limitations of the review

This systematic review was limited to English-language research, indexed in four databases or found through manual searching. Whilst the databases used have been found to be comprehensive and appropriate for evidence synthesis (Chen, 2020; Gusenbauer & Haddaway, 2020), valuable research published elsewhere or in languages other than English might have been missed. After the initial search, several studies were identified that involved both primary and secondary level education. Given the inherent differences in maturity and self-regulation, and therefore capacity for independent learning between primary and secondary school-aged students, it was determined that primary level findings (particularly in the context of the pandemic) would not be translatable to secondary-level education. Therefore, several studies that pooled data from primary and secondary levels were not included in this review. Studies in this review vary in the rigour with which they were conducted, however quality appraisal was undertaken to help mitigate this issue.

While this review has synthesised a range of emerging practices, there is a need for further research and local policy development, particularly in relation to online assessment, to develop guidelines for emerging assessment practices. Specific consideration of how to manage cheating, support student well-being and the impacts new tools will have on teacher workload should be a priority. Stakeholders who evaluate digital technologies and resources should consider the practical hindrances to implementing online assessment practices effectively. Developers and buyers of digital tools and resources for assessment need to recognise the wide variety of assessment practices (as described in

this review) that can be undertaken online and assessment tools should be designed based on subject or skill specific needs. The authors acknowledge that there are other important aspects of online learning to consider such as the potential for discrimination and cyber-bullying, issues around safeguarding and ethical concerns, and matters of data privacy and data security. Although these were not a focus of this review this should not be interpreted as their being less important.

Future research and development

Future systematic literature reviews could examine additional aspects of online learning. On a student/school level, systematic reviews exploring discrimination, specific learning design for students with SEND and school refusers, or interventions to support re-entry to school for students who have dropped out during the pandemic are needed. Stakeholders should focus on the development of contingency plans, addressing the challenges reported in this review and include specific policy relating to safeguarding, data privacy and ethical concerns, to build resilience to future crises. During the pandemic, the accessibility and usability of digital technologies and resources enabled or hindered successful education. One report (Education, 2021) suggested that software developers could 'consider ways of facilitating interactions and personalised feedback'. The findings of this review reiterate this need and emphasise that as several studies banned assessments and cited teacher insecurities implementing equal and fair online assessment, that research into online assessment is needed alongside development of local policies in this area.

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Appendix A - Data extraction coding scheme

- Publication Type
 - Journal article (peer reviewed)
 - Journal article (teacher magazine)
 - Editorial
 - Journal article (pre-print, not peer-reviewed)
 - Conference paper
 - Book chapter
 - Report
 - Data set
 - Website article
- Methodology
 - Date of data collection
 - Unclear
 - Before Jan 2020
 - January 2020
 - February 2020
 - March 2020
 - April 2020
 - May 2020
 - June 2020
 - July 2020
 - August 2020
 - September 2020
 - October 2020
 - November 2020
 - December 2020
 - January 2021
 - Method
 - Qualitative
 - Quantitative
 - Mixed Methods
 - Data Collection
 - Interviews
 - Survey
 - Focus groups
 - Content/Thematic analysis
 - Documents
 - student production (writing, art, digital, e.g., 3D printed robots), artefacts, student programmes, teaching material, written reflections, lesson plans*
 - Observation/Field notes
 - Test (assessment)
 - System log data
 - Dashboard or LMS data*
 - Tracking device data (eye tracking, mouse tracking) Sensors*
 - Respondent diary
 - Length of study

- Unclear
- Less than 1 week
- 1 week
- 2 weeks
- 3 weeks
- 1 month
- 5 weeks
- 6 weeks
- 7 weeks
- 2 months
- 3 months
- 4 months
- 6 months
- 7 months
- 9 months
- Setting/Context
 - Participant Country
 - Country not indicated
 - Argentina
 - Australia
 - Austria
 - Belgium
 - Bhutan
 - Bosnia Herzegovina
 - Brazil
 - Burundi
 - Canada
 - Central African Republic
 - Chile
 - China
 - Colombia
 - Costa Rica
 - Croatia
 - Czech Republic
 - Denmark
 - Dominican Republic
 - Ecuador
 - Egypt
 - Estonia
 - Finland
 - France
 - Georgia
 - Germany
 - Ghana
 - Greece
 - Hong Kong
 - Hungary
 - Iceland
 - India
 - Indonesia
 - Iran

- Ireland
- Israel
- Italy
- Jamaica
- Japan
- Jordan
- Kazakhstan
- Kenya
- Latvia
- Lithuania
- Macedonia
- Madagascar
- Malaysia
- Malta
- Mexico
- Morocco
- Nepal
- New Zealand
- Nigeria
- Norway
- Pakistan
- Peru
- Philippines
- Poland
- Portugal
- Republic of Korea
- Romania
- Russia
- Saudi Arabia
- Senegal
- Slovak Republic
- Slovenia
- South Africa
- South Korea
- Spain
- Sweden
- Switzerland
- Tajikistan
- The Netherlands
- Timor-Leste
- Tunisia
- Turkey
- UAE
- Uganda
- UK
- Ukraine
- Uruguay
- USA
- Vietnam
- Zambia
- Zimbabwe

- Bulgaria
 - Cyprus
- Participant Continent
 - Africa
 - Asia
 - Europe
 - Oceania
 - Middle East
 - North America
 - South America
- Country wealth status
 - Low income country
 - Lower middle income country
 - Upper middle income country
 - High income country
High income country
 - Country not indicated
- Subject

Where the subject under investigation is explicit (that is, they only researched one or more particular subjects), please code it.

 - Subject not mentioned
 - Maths
 - Physical Education
 - Literacy
 - English (first language)
 - English as a second/foreign language
 - Biology
 - Science
 - Physics
 - Chemistry
 - Engineering
 - History
 - Social Studies
 - Geography
 - Liberal Studies
 - ICT
 - Chinese (first language)
 - Information Literacy Skills
 - Music
 - Art
 - Technology
 - Agriculture
 - Religious education
 - Dance
 - Chinese as a second/foreign language
 - Economics
 - Performing Arts
 - German (second language)
 - Indonesian (first language)
 - Arabic
- School status

- Government school
 - Private/independent school
 - Not stated
 - Unclear
- Population
 - Number of participants
 - Choose appropriate checkbox and type exact number into INFO box.*
 - 1-25
 - 26-50
 - 51-99
 - 100-299
 - 300-499
 - 500-749
 - 750-999
 - 1000+
 - Not stated
 - Participant Focus
 - In observations, who is the focus?*
 - In surveys, who is answering?*
 - Teachers
 - Students
 - Parents
 - School Leaders
 - District administrators
 - Learning designers
 - Government officials
 - Year Level
 - Year level of students where mentioned.*
 - Choose as many as appropriate. Choose 'Unclear/Secondary' where specific year levels not mentioned.*
 - Unclear/Secondary
 - Year 7
 - Year 8
 - Year 9
 - Year 10
 - Year 11
 - Year 12
 - Year 13
 - Student variables
 - SEND students
 - Special educational needs and disabilities*
 - Migrants/Refugees
 - Low-income background
 - Where the information is given explicitly that lower-income students are included, please indicate this and feel free to code text that provides further information about them here.*
 - Low attainment
 - Gender
 - Males
 - Females
 - Other or not disclosed

- Our research questions
 - RQ1. Student motivation/engagement
In what ways did emergency remote education affect motivation and engagement in secondary students?
 - RQ2. Online assessment
How did research report on emerging online assessment practices in secondary schooling during the pandemic?
 - RQ3. Peer collaboration
Are new approaches to peer collaboration emerging and what does this suggest?
 - RQ4. Parent engagement
How does online learning in secondary schools support parent engagement?
- Intervention
 - Technology Types Used
 - Synchronous collaboration tools
Audio-Video conferencing (e.g., Zoom)
Collaborative writing tools (e.g., Google Docs)
 - Video conferencing (unknown)
 - Zoom
 - Teams
 - Webex
 - Skype
 - Google Meet
 - Google Docs
 - Tencent Meeting
 - Explain Everything
 - Jitsi
 - Google Workspace for Education
Google Workspace for Education Fundamentals (Formerly known as G Suite for Education) Â·
 - Any video conferencing
 - Multimodal production tools
Animations
Tutorials Recorded lectures Videos Podcast/Vodcast Screencast Authoring tools Voice recorder
 - Videos (teacher made)
 - Videos (made by others)
 - Videos (uncertain origin)
 - Khan Academy
 - YouTube
 - Oak Academy
 - BBC Bitesize
 - Twinkl
 - Movie Maker
 - Edpuzzle
 - Podcasts
 - Scratch
 - Zmaker
 - Autodesk SketchBook
 - FastStone Capture
 - TEDEd
 - Glerups

- URPlay
- Screencastify
- Flipgrid
- PowToon
- Alcodey
- Sonometer app
- Macromedia Flash
- Studio (Canvas)
- Oak Academy
- Knowledge organisation & sharing
 - LMS (e.g., Google Classroom)*
 - Cloud storage*
 - Bookmarking*
 - Diary tool in Moodle*
 - Other LMS
 - Google Classroom
 - Edmodo
 - Class Dojo
 - Moodle
 - Blackboard
 - Daymap
 - Schoology
 - Aula
 - Cloud storage (e.g., Google Drive)
 - Dropbox
 - Google Drive
 - SLearning platform
 - PlayPosit
 - Seesaw
 - Microsoft 365
 - Bingel
 - Gsuite
 - Showbie
 - WebAssign
 - Padlet
 - MeisterTask
 - Compass
 - EduPage
 - ItsLearning
 - Canvas
 - OneNote
- Text-based tools
 - Discussion forums*
 - Readings Newsletter*
 - Text RSS*
 - Interactive textbook*
 - Annotation tools*
 - Email*
 - Chat*
 - Instant messaging*
 - Wikis*
 - Discussion forums
 - Email
 - Chat/Messaging (unknown)
 - WhatsApp
 - DingTalk (Alibaba)
 - WeChat
 - CCTalk
 - Chaoxing

- Google Slide Deck
 - PowerPoint
 - School website
 - Interactive eBook
 - iBooks
 - International Children's Digital Library
 - Word
 - Excel
 - Telegram
 - Jabber
 - GroupMe
- Social networking tools
 - Social platforms (e.g., Facebook)*
 - Microblogging (e.g., Twitter)*
 - Facebook
 - Twitter
 - Social media
 - Social networks
 - DingDing
 - Instagram
 - Snapchat
- Assessment tools
 - eAssessment*
 - Quizzes ARS Open badges Online exams*
 - Self-assessment quizzes
 - Socrative
 - Kahoot
 - Google Forms
 - Formative
 - Microsoft Forms
 - In-built tests and assignments (within LMS)
- Learning games
 - Computer games
 - Paragraph Punch
<https://paragraphpunch.com/>
 - Video games
 - Sumdog
<https://pages.sumdog.com/>
 - Spelling City
<https://www.spellingcity.com/>
 - Codecombat
 - TT Rockstars
 - Education Perfect
 - Hegarty Maths
- Non-tech printed materials
 - Textbooks and printed materials
- MOOCs
 - MOOCs
- Website creation tools
 - Blogs*
 - ePortfolios*

- Blogs
 - GeoGebra Notes
 - Data analysis tools
 - Learning analytics dashboard*
 - Learning analytics dashboard
 - Mobile learning
 - Apps*
 - mLearning*
 - mLearning
 - Virtual worlds
 - Virtual lab*
 - Simulations Virtual worlds*
 - Minecraft
 - Augmented reality
 - PhET
 - Physics Education and Technology simulation media*
 - Other technology
 - TV lessons
 - Radio
 - CMACC
 - Laptops
 - The OT Toolbox
 - <https://www.theottoolbox.com/>
 - Sli
 - Audio book
 - Devices used
 - None listed
- Assessment
 - Online exams
 - Exams that are held solely online using technology.*
 - Portfolio
 - A collection of student work, housed online.*
 - Choose your own adventure
 - A task where students are provided with multiple activity options that they can choose from.*
 - Peer assessment
 - Where peers assess each other's work.*
 - Self-assessment
 - Where students assess their own work.*
 - Online quizzes
 - Short quizzes (often multiple choice) that students answer online, e.g., Kahoot.*
 - Research project
 - Large project that is presented online.*
 - Reflective learning journal
 - Where students reflect on what and how they have learned, e.g., a blog.*
 - Flipped feedback
 - Where teachers record themselves (video or just audio) going through student work.*
 - Formative online feedback
 - Diagnostic/formative feedback*

- Assessment submission
How students are submitting work
 - No assessment allowed
 - Worksheets
 - Conversations/Speaking assessment
 - Video project makers
 - Images
Students send a photo of their work
 - Project-based (not research)
 - Checklists
 - General challenges with conducting assessment
 - Online debate
 - Providing exemplars of student work
 - Videos
 - Live marking
 - Differentiation
 - At home experiments
- Pedagogical approaches
 - Flipped learning
*Where students learn through watching videos (either teacher made or made by other educators) in their own time, and then apply concepts learned in the group space.
An example is the Weinhandl (2021) study in this review.*
 - Collaborative learning
Where students undertake learning activities in pairs or in groups, in order to achieve learning outcomes.
 - Self-directed learning
Independent learning. Students take responsibility for what to learn, when and how. It could include selection of topic, resources, mode of assessment. An example would be where students have to undertake a research project, where the topic and design of the task, as well as pacing of work undertaken, is completely up to them. Creating ePortfolios are often examples of self-directed/self-regulated learning (see Weinhandl 2021).
 - Inquiry-based learning
 - Teacher professional development
Not a pedagogical approach per se, but related
- Outcomes
 - Student
 - Positive/Increased Motivation
Evidence of students being motivated, e.g., "94.4% considered that Alcody motivated them to learn how to program even during the COVID-19 pandemic when they were at home using Alcody online"
 - Negative motivation/demotivation
Evidence of students being demotivated, e.g., e.g., some parents were concerned that their children seemed to lack motivation and were easily distracted [...]Not putting in effort as they think no one else is. Not taking learning at home seriously. [...]They don't want to. It's such a struggle.
 - Positive overall engagement
Where a study has measured engagement generically, without specifying exactly what aspect of engagement they're focused on, e.g., "Online learning is more engaging, M = 4.0"

- Disengagement
 - Where a study has measured disengagement generically, without specifying exactly what aspect of disengagement they're focused on (which should be coded underneath the individual domains, e.g., Cognitive Disengagement)*
- Learning gains
 - Where students have increased the amount of learning, e.g., "It is clear that students learned a lot about preventive health care and SARS-CoV-2, with more than 70% of students responding e.g., agree and e.g., strongly agree. The number for sustainable development knowledge was around 50%.*
- Learning loss
 - Where a study has indicated less learning somehow, or where learning loss has been measured in absolute terms, e.g., "e.g., They learned, but less than they would have in school 51.11% according to teachers"*
 - "These barriers resulted in 7 out of 10 students indicating that grades in their classes dropped during online learning in the spring."*
- Better for males
- Better for females
- Worse for males
- Worse for females
- No significant differences found based on gender
- Parent engagement
 - Parental involvement & engagement with learning
 - Examples of parents being involved or engaged with their child's learning. Can also be examples of difficulties in parents engaging.*
 - Relationships
 - Evidence of relationship building with the school community (parents, teachers etc), or difficulties in relationship building.*
 - Communication
 - Home-school communication, preferably about how schools communicate with parents using specific technology.*
 - Attitude towards learning
 - Evidence of parent attitudes towards learning or activities.*
 - Self-efficacy (as educator)
 - Evidence of parent opinions about themselves as an educator (as a direct result of online/blended learning).*
 - ICT skills & knowledge
 - Evidence around parent ICT skills & knowledge.*
- Peers
 - Collaborating with peers
 - Evidence of importance of peer interaction, or how collaboration was facilitated through technology.*
 - Co-creating learning materials
 - Specific collaboration between students to create something together, e.g., lesson notes, revision guide, presentation.*
- Learning environment & technology
 - Access to technology
 - Impact of internet or device access on students' learning, engagement or motivation.*
 - Usability
 - How the ability to use technology affected learning, e.g., accessibility, design.*

- Internet connection
- Curriculum/Activities
 - Design
 - How the design/pacing of activities affected learning and/or engagement.*
 - Content length
 - Impact of*
 - *Video length - Activity length*
 - Feedback
 - *What students thought of how feedback was given.*
 - *How did specific types of online feedback affect learning and/or student/parent engagement?*
- Cognitive engagement
 - Critical thinking
 - The process of actively conceptualising, applying, analysing, synthesising, and/or evaluating information.*
 - Setting learning goals
 - Students setting learning goals for themselves/working to achieve a certain level.*
 - Understanding
 - Students develop greater understanding of learning material, or of how to perform certain tasks.*
 - Reflection
 - Student reflection on their own learning/knowledge, learning processes or skills.*
 - Focus/concentration
 - Improved/enhanced ability to focus or concentrate.*
 - Deep learning
 - Students learn concepts to a deeper level (not just surface level understanding) and retain the information.*
 - Learning from peers
 - Students learn from other students.*
 - Follow through/care/thoroughness
 - Students show particular care in their work, or ensure completion to a high standard. They finish what they start.*
 - Preference for challenging tasks
 - Students choose to complete work of a higher level, or challenge themselves to work to a higher standard.*
 - Teaching self and peers
 - Students take initiative to teach themselves and/or other students new concepts.*
 - Positive perceptions of teacher support
 - Students find teacher feedback, teaching, and/or support good.*
 - Self-regulation
 - Students manage aspects of their own learning, without being asked to do so. Students monitor their own thinking and make their own decisions as they're engaged in learning activities.*
 - Positive self perceptions/self-efficacy
 - Students acknowledge their skills or knowledge have improved, or see that they have accomplished something.*
- Affective engagement

- Enthusiasm
Students show enthusiasm about something (intense and eager enjoyment, interest or approval)“ code this if the word enthusiastic or enthusiasm is used.
- Satisfaction
Students are satisfied with something to do with their learning (activities/assignments, teaching, online learning, technology etc).
- Curiosity
Evidence of a desire to know or learn something.
- Sense of connectedness
Students feel connected to or at home among their classmates.
- Positive attitude towards learning
Students display a positive approach towards learning.
- Sees relevance
Students can relate what they learn to real life/to their own lives, or they see the reason for learning something in a particular way.
- Feeling appreciated
Students feel appreciated for the work they do or the role they have played in the class.
- Pride
Students feel proud of their skills or knowledge, or of any other aspect relating to their learning.
- Excitement
Students are excited about their learning.
- Enjoyment
Students enjoy an aspect of their learning (e.g., the teaching method used, the activities)
- Positive interactions with peers
Working well with other students.
- Positive interactions with teachers
Positive communication, interaction and/or connection between students and their teacher/s.
- Interest
Students show interest in their learning/activities/teaching method etc.
- Sense of wellbeing
Students feel comfortable and happy with their learning and/or within their learning environment.
- Behavioural engagement
 - Effort
Students expend effort in their learning, e.g., doing extra work, watching videos multiple times.
 - Study habits
Students talk positively about studying/doing homework.
 - Attending live lessons
Positive attendance to live lessons (any synchronous activities - conference calls, collaborative writing etc).
 - Increased interaction with peers
Increased interaction and collaboration with fellow students.
 - Increased interaction with teachers
Increased interaction with teachers through activities, feedback, online lessons and so on.

- Homework completion
Students complete set homework/activities, e.g., watching videos.
- Positive conduct
Students behave and do the right thing (e.g., in online lessons).
- Participation/involvement
Students participate or get more involved in their learning somehow.
- Asking teacher or peers for help
*Students ask the teacher or peers for help.
e.g., For example, they were more willing to ask for help and contribute key mathematical ideas rather than wait for these to be provided during a homework review.*
- Assuming responsibility
*Students take responsibility for their learning and/or behaviour.
e.g., Many students explained that the flipped classroom required that they assume more responsibility for their own learning, especially outside of the classroom. Lucas talked about this external classroom experience: You actually have to be an adult. You have to self-teach yourself. You have to watch stuff at home. You have to do your work. You need to stay on top to make sure you continuously grow as a student.*
- Confidence
Students display increased confidence in an aspect of their learning, e.g., asking questions, undertaking/completing activities.
- Amount of time studying/Time on task
Increased time on task (when completing activities).
- Cognitive disengagement
 - Unwilling
*Students resist or are unwilling to complete tasks or participate in live lessons for example.
e.g., Interview of the students who participated in the flipped classroom approach indicates that the biggest issue that was found related to students acceptance of the format. Students were resistant at first to the concept of having to watch videos and do work at home which were new to them.*
 - Apathy
Students are apathetic towards learning activities and-or online learning in general. Lack of interest, enthusiasm, or concern.
 - Helpless
*Students feel unable to act without help.
e.g., Can it be more complicated to control my avatar? Someone please give me a hand*
 - Opposition/rejection
Students flat out refuse to do something or are completely against online learning, for example.
 - Avoidance
Students avoid completing activities and/or doing things that might be difficult.
 - Pressured/stressed
Students feel stressed or pressured as a result of their learning/technology etc.
 - Unfocused/inattentive
Students cannot concentrate on activities or in live lessons.

- e.g., students reported that staying focused when watching videos was a challenge. "I cannot focus on watching videos, not even 2 minutes"*
- Distracted
 - Students are distracted by things other than their learning.*
 - "Sometimes when I am doing the pre-learning on my mobile phone, there are messages popping up frequently at the top of the screen and I have to reply"*
 - Confusion
 - Affective disengagement
 - Boredom
 - Students express boredom around some aspect of their learning.*
 - Student A (Traditional): e.g., Sometimes the PowerPoint presentations were boring and unclear.*
 - Anger
 - Students are angry about some aspect of their learning and/or the technology they have to use.*
 - Dislike
 - Students dislike an aspect of their learning, e.g., the activities, the technology used, online learning in general.*
 - Disinterest
 - Students have lost interest in their learning.*
 - Dissatisfaction
 - Students are dissatisfied about some aspect of their learning.*
 - e.g., a minority of students expressed strong opinions that they did not enjoy working as a pair and some of these reported that their partners did not equitably contribute to the workload*
 - Disappointment
 - Students are disappointed about an aspect of their learning, e.g., grades, interaction.*
 - e.g., . . .miss out on discussions and explanations on certain topics. . .*
 - Frustration
 - Students are frustrated about an aspect of their learning.*
 - e.g., Students shared it was frustrating when there was no one around to answer questions.*
 - Worry/anxiety
 - Students are worried or anxious about an aspect of their learning.*
 - e.g., Taking control of their learning was an attribute that caused anxiety amongst the student-participants. The fear of not being able to immediately ask questions and having to delve into the content in order to gain understanding was evident in the journals compiled by the participant-researcher for the first couple of days.*
 - Overwhelmed
 - Students are overwhelmed by an aspect of their learning, e.g., using different technology, the amount of work to complete.*
 - Lack of confidence
 - Students are not confident about an aspect of their learning, e.g., talking in online lessons.*
 - Negative or no interaction with teachers
 - Behavioural disengagement
 - Procrastination
 - Students put off doing work or procrastinate in some way.*

- e.g., At first, if I had a lot of homework, I would put off the videos thinking I would just get the information in class then next day*
- Half-hearted

Doing tasks in a half-hearted manner, not doing them to the best of a student's ability.

e.g., Many students identified that a lack of personal effort was the root of a stagnant learning.
 - Absent

Students do not attend scheduled classes.

e.g., In a survey completed by 81% of students registered for the manufacturing processes course, 35% reported not attending all the lectures. However, only 10% suggested that this was due to the podcast availability.
 - Giving up

Students give up, e.g., on completing homework/activities, or watching videos.
 - Burned out/exhausted

Students are exhausted as a result of their learning.
 - Poor conduct

Students misbehaving.

e.g., Higher instances of off-task behaviour were observed in the flipped classroom. Discussion with the teacher and class observations revealed instances of students listening to music on YouTube when the expectation was to be working.
 - Unprepared

Not being prepared for learning (e.g., live lesson) or assessment (e.g., exam).

e.g., in the first few days of the first week, there were several students unprepared for the class time and had difficulty in joining the group discussion and activities in class.
 - Task incompleteness

Not completing work set by the teacher.

e.g., One of the biggest problems we have encountered is students not watching the video at home.
- Social disengagement
 - Social isolation

Isolated due to covid restrictions, lockdown, school closure
 - Decreased teacher-student interaction

Appendix B - Studies included in the review

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Agustin et al.</u>	2020	Asia	Indonesia	-	S	33	10	TBT
<u>Al Salman et al.</u>	2021	Middle East	Jordan	-	S	720	-	-
<u>Aldossry</u>	2021	Middle East	Saudi Arabia	-	T	3	-	SCT,MPT, KOS, AT
<u>Almarashdi & Jarrah</u>	2021	Middle East	UAE	Maths	S	580	9 - 12	KOS
<u>Álvarez-Guerrero et al.</u>	2021	Europe	Spain	Literacy	S, T	5	-	SCT, Other
<u>Amelia et al.</u>	2020	Asia	Indonesia	Maths	S, T	10	7	SCT, KOS, TBT, AT
<u>Ang & Wu</u>	2021	Asia	China	-	S, T	411	-	SCT, MPT, TBT
<u>Asanov et al.</u>	2021	South America	Ecuador	-	S	1500	10 - 12	SCT, MPT, KOS, TBT, print
<u>Asvial et al.</u>	2021	Asia	Indonesia	-	S	50	-	-
<u>Atmojo & Nugroho</u>	2020	Asia	Indonesia	ESL/EFL	T	16	-	SCT, MPT, KOS, TBT, AT
<u>Azhari & Fajri</u>	2021	Asia	Indonesia	-	T	353	-	SCT, MPT, KOS, TBT, Other

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Babincakova & Bernard</u>	2020	Europe	Slovakia	Chemistry	S, T	95	-	SCT, MPT
<u>Balkist & Agustiani</u>	2020	Asia	Indonesia	Maths	S	3	10	SCT
<u>Baptista et al.</u>	2020	Europe	Portugal	Engineering, Science, Maths, ICT, Physics	T	4	8	SCT, MPT, KOS, TBT, SNT
<u>Becker et al.</u>	2020	North America	USA	-	S, P	238	9 - 11	SCT, MPT, print
<u>Bhattarai</u>	2020	Asia	Nepal	ESL/EFL	T	2	-	SCT
<u>Bhaumik & Priyadarshini</u>	2020	Asia	India	-	S	74	11, 12	-
<u>Bruin</u>	2020	Oceania	Australia	Music	T	15	-	SCT
<u>Budianto & Arifani</u>	2021	Asia	Indonesia	ESL/EFL	S, T	317	-	TBT
<u>Cheung</u>	2021	Asia	Hong Kong	ESL/EFL	T	1	-	SCT, TBT, AT
<u>Chirinda et al.</u>	2021	Africa	South Africa	Maths	T	23	12	SCT, MPT, KOS, TBT, SNT
<u>Chiu</u>	2021	Asia	Hong Kong	-	S	1201	8, 9	SCT
<u>Chiu</u>	2021	Asia	Hong Kong	-	S, T	54	-	-

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Clausen et al.</u>	2020	North America	USA	-	T	44	7 - 12	SCT, MPT, KOS, Other
<u>Code et al.</u>	2020	North America	Canada	Technology	T	42	-	-
<u>Dema et al.</u>	2021	Asia	Bhutan	-	S	200	-	-
<u>Dietrich et al.</u>	2020	Europe	Germany	-	S	1735	-	-
<u>Dorji</u>	2021	Asia	Bhutan	-	S, T, P	40	9, 11	KOS
<u>Easterly et al.</u>	2021	North America	USA	Agriculture	T	4	-	SCT, KOS, TBT, print
<u>Education Scotland</u>	2021	Europe	UK (Scotland)	-	S, T, P, SL	-	-	SCT, MPT, KOS, TBT, AT, DAT
<u>El Iq Bali & Mursrifah</u>	2020	Asia	Indonesia	RE	T	1	11	TBT
<u>Ferraro et al.</u>	2020	Europe	Italy	-	S	83	-	SCT
<u>Gordy et al.</u>	2021	North America	USA	Science	T	11	-	SCT, MPT, KOS, print
<u>Hira & Anderson</u>	2021	North America	USA	-	T	11	-	-
<u>Hodgen et al.</u>	2020	Europe	UK	Maths	SL	49	7, 8	SCT, MPT, KOS, TBT, LG

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Hu & Huang</u>	2021	Oceania	Australia	ESL/EFL	S	30	10	SCT, AT
<u>Jayathirtha et al.</u>	2020	North America	USA	ICT	S, T	38	-	SCT, MPT, TBT
<u>Jeong & So</u>	2020	Asia	South Korea	PE	T	6	-	SCT, MPT, TBT
<u>Kaden</u>	2020	North America	USA	Maths, Science	T	1	-	SCT, MPT, KOS, AT, print
<u>Kelley</u>	2020	North America	USA	Chemistry	S	59	-	SCT, KOS, AT, print
<u>Kochan</u>	2021	Europe	Poland	-	S	114	-	SCT, TBT
<u>Korzycka et al.</u>	2021	Europe	Poland	-	S	2408	-	-
<u>Lansangan</u>	2020	Asia	Philippines	Chemistry	T	1	9	MPT, KOS, SNT
<u>Lawrence & Fakuade</u>	2021	Africa	Nigeria	-	S	1407	-	MPT, KOS, TBT, SNT
<u>Lepp et al.</u>	2021	Europe	Estonia	Biology, Science, Chemistry, Physics, Geography	T	16	-	SCT, MPT, KOS
<u>Mælan et al.</u>	2021	Europe	Norway	-	S	1755	8 - 10	-

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Makamure & Tsakeni</u>	2020	Africa	Zimbabwe	Maths, Biology, Physics, Chemistry	T	5	10, 11	SCT, KOS, TBT
<u>Nawawi et al.</u>	2021	Asia	Indonesia	Biology	S	361	10 - 12	SCT, MPT, KOS, TBT, AT
<u>Niemi & Kousa</u>	2020	Europe	Finland	-	S, T, SL	309	-	SCT, KOS, TBT, AT
<u>Nugraha et al.</u>	2021	Asia	Indonesia	ESL/EFL	S	23	-	SCT, MPT, KOS, TBT
<u>Nurliani et al.</u>	2021	Asia	Indonesia	Physics	S, T	71	-	KOS, TBT, SNT
<u>Nusser</u>	2021	Europe	Germany	-	S, P	1452	-	-
<u>Okebukola et al.</u>	2020	Africa	Nigeria, Ghana, Senegal, Burundi, Morocco	Chemistry	T	-	12	SCT, MPT, KOS, TBT, SNT, Other
<u>Oraif & Elyas</u>	2021	Middle East	Saudi Arabia	ESL/EFL	S	379	10 - 12	KOS
<u>Pelikan et al.</u>	2021	Europe	Austria	-	S	2652	-	-
<u>Pirrone et al.</u>	2021	Europe	Italy	-	S	324	14 - 19 years old	-

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Poláková & Klímová</u>	2021	Europe	Slovakia	-	S	72	15 - 19 year old	SCT, KOS
<u>Primdahl et al.</u>	2020	Europe	Denmark	-	T	8	-	SCT, KOS, TBT, SNT
<u>Rahayu & Wirza</u>	2020	Asia	Indonesia	ESL/EFL	T	102	-	SCT, KOS, TBT, AT
<u>Rap et al.</u>	2020	Middle East	Israel	Chemistry	T	193	-	SCT, MPT, KOS, TBT
<u>Rosayanti & Hardiana</u>	2021	Asia	Indonesia	ESL/EFL	S, T	66	-	-
<u>Rusmansyah et al.</u>	2021	Asia	Indonesia	Maths, Science	S	-	11	SCT, KOS
<u>Schaefer et al.</u>	2020	North America	USA	-	S, P	5	7, 9, 11	SCT, KOS, TBT
<u>Shidiq et al.</u>	2021	Asia	Indonesia	Chemistry	T	55	-	SCT, MPT, KOS, TBT, VW
<u>Sibanda & Mathwasa</u>	2021	Africa	Zimbabwe	-	S, T	24	-	TBT
<u>Simanjuntak et al.</u>	2021	Asia	Indonesia	ESL/EFL	S	72	11	MPT
<u>Suliani et al.</u>	2021	Asia	Indonesia	Maths	S, T	18	10	AT

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Suryana et al.</u>	2021	Asia	Indonesia	ESL/EFL, German, Indonesian, Arabic	T	4	10 - 12	TBT
<u>Tong & Wang</u>	2020	Asia	China	ESL/EFL	S	229	14 - 15 years old	MPT
<u>Tran et al.</u>	2020	Asia	Vietnam	-	S	420	-	-
<u>Trung et al.</u>	2020	Asia	Vietnam	-	S	460	7 - 12	-
<u>Turchi et al.</u>	2020	North America	USA	English	T	3	9 - 12	SCT, MPT, KOS, TBT
<u>Velichová et al.</u>	2020	Europe	Slovakia	-	S	2824	10 - 13	SCT, KOS, AT, Other
<u>Weinhandl et al.</u>	2021	Europe	Austria	Maths	S, T	42	10, 11	SCT, MPT, WCT
<u>Willermark</u>	2021	Europe	Sweden	-	T, SL	331	-	SCT
<u>Yan et al.</u>	2020	Asia	China	ESL/EFL	S	287	-	-
<u>Yan</u>	2021	North America	USA	History, PE, Dance, Chinese	S	1	-	SCT, MPT, KOS, TBT, AT
<u>Yang et al.</u>	2020	Asia	China	ESL/EFL	S	287	-	-

Author	Year	Continent	Country	Subject	Participant focus	Participant #	Year levels	Technology types used
<u>Yates et al.</u>	2020	Oceania	New Zealand	-	S	1975	12, 13	SCT, MPT, KOS, TBT, SNT, AT, LG
<u>Zasko & Agung</u>	2021	Asia	Indonesia	-	S	558	-	TBT, print
<u>Zorčić</u>	2020	Europe	Austria	-	T	43	-	MPT, print

Appendix C - Educational technology tool typology (based on Bower, 2016)

Text-based tools	Multimodal production tools	Website creation tools	Knowledge organisation and sharing	Data analysis tools
Discussion forums	Animations	Blogs	LMS	Learning analytics dashboard
Readings	Tutorials	ePortfolios		
Newsletter	Recorded lectures		Cloud storage	
Text	Videos		Bookmarking	
RSS	Podcast/Vodcast		Diary tool in Moodle	
Interactive textbook	Screencast			
Annotation tools	Authoring tools			
Email	Voice recorder			
Chat				
Instant messaging				
Wikis				
Digital Storytelling tools	Assessment tools	Social networking tools	Synchronous collaboration tools	Learning games
Storyboards	eAssessment	Social platforms	Audio-Video conferencing	Computer games
	Quizzes	Microblogging		Video games
	ARS		Collaborative writing tools	Learning games
	Open badges			
Virtual worlds	Other			
Virtual lab	Television lessons			
Simulations	Radio			
Virtual worlds	Audio book			

Appendix D - Quality assessment tool

This tool is designed as a checklist to indicate whether there are any reasons why the evidence claim is not relevant or trustworthy and so not to be relied upon in your synthesis of research evidence. The aim is to record those concerns and to provide a judgment for each of the 2 questions below. It is not necessary to score items for where there is no concern about the basis of the evidence claim and its use in your synthesis.

- Does this study answer our research questions?

Think about topic, method etc.

- Yes
- No
- Partly
- Unclear

- Is the evidence trustworthy, given the method that was used?

Please write concerns in the INFO box. Do the authors make claims that are relevant to us?

- Yes
- No
- Partly
- Unclear

Appendix E - Items by source

Date of search	Database	Number of Items	Duplicates	Total for screening
5 May 2021	Web of Science	782	157	625
5 May 2021	ERIC	2379	21	2358
5 May 2021	Scopus	1697	584	1113
Previous reviews	Bond (2020b)	78	0	78
Previous reviews	Bond (2021)	325	0	325
13 May 2021	Web of Science	6	2	4
16 May 2021	MAG	1000	24	976
May-June 2021	Grey literature	4	0	4
May-June 2021	ResearchGate	2	0	2

Appendix F - Countries where research was undertaken

Country	Wealth Status	Number *	Percentage of studies
Indonesia	LMIC	19	24%
USA	HIC	11	14%
China	UMIC	4	5%
Slovakia	HIC	3	4%
Austria	HIC	3	4%
Hong Kong	HIC	3	4%
Australia	HIC	2	3%
Germany	HIC	2	3%
Italy	HIC	2	3%
Nigeria	LMIC	2	3%
Poland	HIC	2	3%
Saudi Arabia	HIC	2	3%
UK	HIC	2	3%
Vietnam	LMIC	2	3%
Zimbabwe	LIC	2	3%
Bhutan	LMIC	2	3%
Burundi	LMIC	1	1%
Canada	HIC	1	1%
Denmark	HIC	1	1%
Ecuador	UMIC	1	1%
Finland	HIC	1	1%
Ghana	LMIC	1	1%
India	LMIC	1	1%
Israel	HIC	1	1%
Jordan	UMIC	1	1%
Morocco	LMIC	1	1%
Nepal	LMIC	1	1%
New Zealand	HIC	1	1%
Norway	HIC	1	1%

Philippines	LMIC	1	1%
Portugal	HIC	1	1%
Senegal	UMIC	1	1%
South Africa	UMIC	1	1%
South Korea	HIC	1	1%
Spain	HIC	1	1%
Sweden	HIC	1	1%
UAE	HIC	1	1%

* Some studies were conducted in more than one country.

Appendix G - Participant focus

Participant Focus	<i>N</i> Studies	<i>N</i> Studies [%]
Students only	34	42%
Teachers only	27	33%
Parents only	0	0%
School leaders only	1	1%
Students + teachers	12	15%
Students + parents	3	4%
Teachers + parents	0	0%
Parents + school leaders	0	0%
School leaders + teachers	1	1%
School leaders + students	0	0%
Students, teachers + school leaders	1	1%
Students, teachers + parents	1	1%
Students, teachers, parents + school leaders	1	1%

Appendix H - Subjects

Subject	N Studies	N Studies [%]
English as a Second/Foreign language	14	17%
Maths	11	14%
Chemistry	8	10%
Science	5	6%
Physics	4	5%
Biology	3	4%
ICT	2	2%
Physical Education	2	2%
English (first language)	1	1%
Engineering	1	1%
History	1	1%
Music	1	1%
Religious Education	1	1%
Dance	1	1%
Chinese as a second/foreign language	1	1%
German (second language)	1	1%
Indonesian (first language)	1	1%
Arabic	1	1%
Literacy	1	1%

Geography	1	1%
Technology	1	1%

Appendix I - Number of participants per study

Number of participants	<i>N</i> studies	<i>N</i> studies [%]
1-25	27	33%
26-50	9	11%
51-99	11	14%
100-299	8	10%
300-499	10	12%
500-749	3	4%
1000+	10	12%
Not stated	3	4%

Appendix J - Data collection methods

Data Collection	N Studies	N Studies [%]
(Online) survey	53	65%
Interviews	33	41%
Observation/Field notes	10	12%
Documents	10	12%
Focus group	6	7%
Test (assessment)	3	4%
Respondent diary	3	4%

Appendix K - Technology used

Technology Type	N studies	%
Synchronous collaboration tools	47	58%
Knowledge organisation & sharing	37	46%
Text-based tools	35	43%
Multimodal production tools	31	38%
Assessment tools	15	19%
Social networking tools	8	10%
Other technology	5	6%
Learning games	2	2%
Website creation tools	1	1%
Data analysis tools	1	1%
Virtual worlds	1	1%

International Public Policy Observatory (IPPO)

IPPO is an ESRC funded initiative to provide decision-makers in government at all levels with access to the best available global evidence on the social impacts of the COVID-19 pandemic, and the effectiveness of policy responses. IPPO is a collaboration between the Department of Science, Technology, Engineering and Public Policy (STeAPP) and the EPPI Centre at UCL; Cardiff University; Queen's University Belfast; the University of Auckland and the University of Oxford, together with think tanks including the International Network for Government Science (INGSA) and academic news publisher The Conversation.

EPPI Centre

Founded in 1996, the EPPI Centre is a specialist centre in the UCL Social Research Institute. It develops methods: (i) for the systematic reviewing and synthesis of research evidence; and (ii) for the study of the use research. As well as being directly involved in the academic study and the practice of research synthesis and research use, the centre provides accredited and short course training programmes in research synthesis and social policy and research.

UCL Social Research Institute (SRI)

The SRI (formerly the Department of Social Science) is one of the leading centres in the UK for multidisciplinary teaching and research in the social sciences. With more than 180 academic, research and professional staff, it works to advance knowledge and to inform policy in areas including gender, families, education, employment, migration, inequalities, health and child/adult wellbeing.

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