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Schools and emergency remote education during the COVID-19 pandemic: A living rapid systematic review

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Abstract: The COVID-19 pandemic in 2020 has had an unprecedented impact on education around the world. In order to understand and face this challenge, educators and researchers undertook a range of research, however the time that teachers have to undertake professional development and seek out such literature to inform their practice has been sorely lacking. Furthermore, literature exploring the wider variety of stakeholder experiences has been suggested to be missing. This living rapid systematic review synthesises K-12 research on teaching and learning during the COVID-19 pandemic, published in English and indexed in 5 international databases. 89 studies were included for synthesis in the present article, and the results are discussed against a bioecological model of student engagement. The results indicate that the majority of research was conducted in Europe and Asia, predominantly focused on teachers, with more studies undertaken in high schools. Online surveys were the most used method, although future research must include all study design information. Recommendations from the literature include providing further funding for professional development and equipment, prioritising equity, designing collaborative activities, and using a combination of synchronous and asynchronous technology. Gaps in the literature are highlighted and practical tips for teachers are provided.

Keywords: COVID-19, K-12, emergency remote education, educational technology, online learning

Highlights

What is already known about this topic:

- The COVID-19 pandemic impacted education provision around the world.
- The quality of teaching, feedback and peer interaction are crucial in distance and online learning.
- Collaborative technologies are particularly linked to engagement, and videos not created by teachers are more likely to lead to disengagement.

What this paper contributes:

- A synthesis of 89 studies in K-12, from 70 different countries, including information about what research has been conducted during the pandemic, where, when and by whom.
- Provides an overview of topics studied, including which factors within the microsystem have been the most influential/prevalent, as well as specific recommendations from the literature.

Implications for theory, practice and/or policy:

- Clear policy and direct guidance need to be provided to schools, as well as increased professional development and access to devices/adequate infrastructure.
- Teachers should design activities with interaction to decrease feelings of isolation and boost engagement, engage in professional networks, and keep open communication with families.
- Future research must include all study design information, and further exploration is needed of the experiences of vulnerable populations.

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Introduction

The impact of the Coronavirus pandemic from early 2020 was felt around the world, with educational institutions having to abruptly make the switch to emergency remote education (ERE); some with days of warning, and some with only a matter of hours (Bozkurt & Sharma, 2020b; Hodges et al., 2020). Faced with an unprecedented situation for many, teachers and schools sought to ensure that their students could continue learning at home, with a range of solutions implemented, including issuing printed materials, providing access to educational apps and websites, and employing new learning management systems, or reviving old ones (Bozkurt et al., 2020). However, despite widespread hopes that the pandemic would soon come to an end, ceasing extended periods of lockdown and the need for emergency remote teaching, second waves and mutations of the virus now mean that interruptions to 'normal' schooling could continue well into 2021 (e.g., Coughlan, 2020b), causing schools and teachers further stress (Kim & Asbury, 2020).

Practitioners and researchers around the world have been trying to understand how ERE has been implemented, seeking to identify ways of effectively engaging students in learning whilst at home during this incredibly difficult time. It is crucial to explore how home learning is implemented by all stakeholders (teachers, school leaders, and parents) (Andrew et al., 2020), given the array of influences on student engagement within their learning environment (see Bond & Bedenlier, 2019). However, calls have been made for further research into a number of areas that appear to be lacking during this initial pandemic period, including specifically investigating the role that parents and home knowledge can play in student learning (Richmond et al., 2020), as well as how students with special educational needs and disabilities (SEND) have been impacted (Lucas et al., 2020).

In a study of international teachers and school leaders from 59 different countries (Reimers & Schleicher, 2020), 84.47% (n = 839) indicated that they would 'Undertake research into what other countries have done and engage in international peer learning'. However, given the workload and amount of stress currently placed on teachers, the amount of time they have to devote to professional development, especially outside of school hours, is understandably limited (Flack et al., 2020; Hamilton et al., 2020). Therefore, this rapid systematic review seeks to provide an overview of research that was undertaken during the first seven months of the pandemic, in order to highlight the successes, challenges and recommendations for the future, so that we might continue to adapt and strengthen teaching and learning going forward (Bozkurt & Sharma, 2020a). It has also been designed as a living review that will be frequently updated, which will be easily accessible online and available as an open repository of research, with the hopes of informing both educational policy and practice, as well as future research.

Literature

Student engagement and educational technology

Student engagement in learning is complex and multifaceted (Appleton et al., 2008; Fredricks et al., 2004; Kahu, 2013), influenced by a range of macro, exo, meso and micro level factors, each impacting upon the other (see Figure 1). Whilst the present article does not allow lengthy consideration of the concept (see Bond & Bedenlier, 2019; Bond et al., 2020), student engagement can be defined 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., 2020, p. 3)

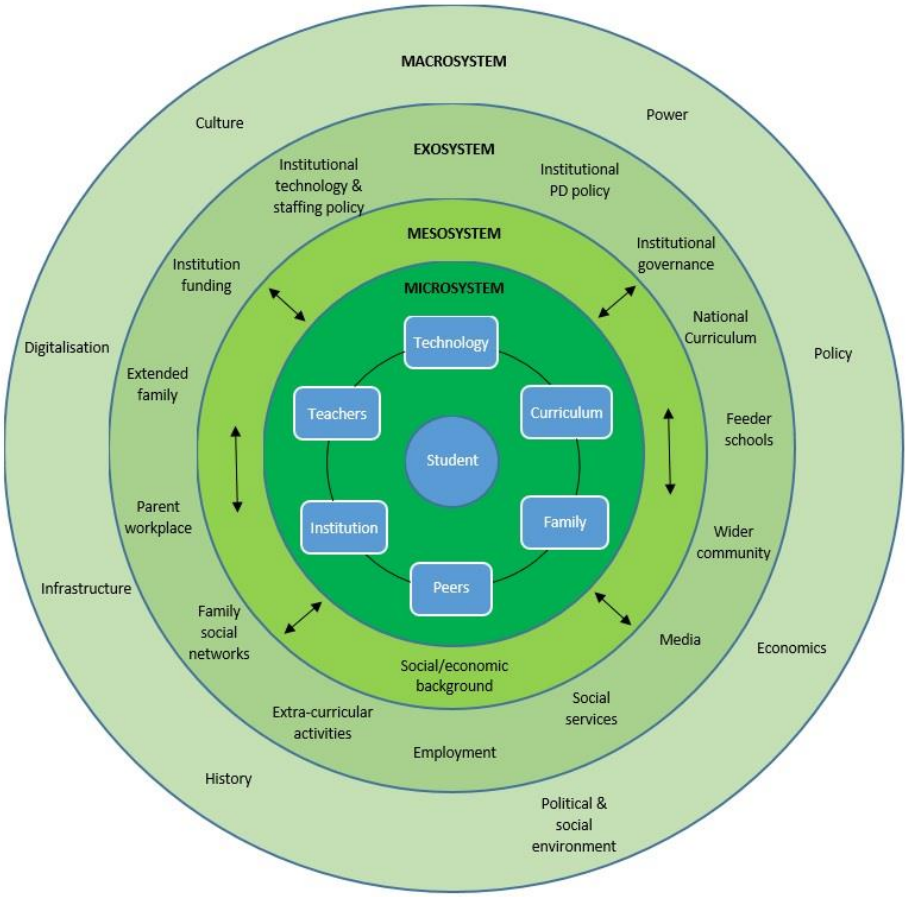

Figure 1. Bioecological model of student engagement (Bond, 2020a, p. 35)

Within the microsystem of learning, whether that be at school or at home, the student is at the centre, with their own range of internal influences. External influences within the microsystem include their institution (the school) (see Borup et al., 2014), their family (e.g., Diogo et al., 2018), teachers (e.g., Pedler et al., 2020), peers (e.g., Zepke & Leach, 2010), the curriculum (see Xiao, 2017) and technology used (e.g., Bergdahl et al., 2020; Bond, 2020b). Further investigation of which and how these influential factors have impacted student learning during the pandemic, can help inform policy and practice going forward.

Previous K-12 online and blended learning research

Whilst prior research has found that educational technology can predict increased student engagement (Chen et al., 2010; Rashid & Asghar, 2016), and can positively impact on multiple indicators of engagement (Bond, 2020b; Schindler et al., 2017), far fewer studies have focused on the use of educational technology in the K-12 context (Pérez-Sanagustín et al., 2017). In order to provide quick insight for educators on how to conduct remote teaching, the Education Endowment Foundation (2020) produced a rapid evidence assessment of prior systematic reviews and meta-analyses, including research on blended and computer-supported collaborative learning. Aside from the obvious need to provide access to technology, especially for disadvantaged students, the review found no clear difference between using asynchronous or synchronous methods, but rather that it was the quality of teaching that was the most important, with a focus on clear explanations, scaffolding and providing effective feedback (e.g., van der Kleij et al., 2015; Verschaffel et al., 2019). Peer interaction and opportunities to collaborate were found to enhance motivation and learning outcomes (e.g., Cui & Zheng, 2018; Poirier et al., 2019), and providing strategies for students to be able to work independently at home, such as providing structured daily plans and checklists, could lead to improved outcomes (e.g., Rasheed et al., 2020).

The systematic review of research on the flipped learning approach and student engagement by Bond (2020b), included 107 studies, predominantly undertaken within North American and Asian high schools, and heavily focused on STEM subjects. The review found that collaborative technologies, such as Google Docs, and platforms such as Google Classroom and Edmodo, were particularly linked to engagement, with videos not created by teachers more likely to lead to disengagement. The lure of videos on YouTube, social media and other non-school related uses of educational technology has also been found to impact student learning performance and engagement negatively, especially for students already prone to disengagement (Bergdahl et al., 2020). It would therefore be interesting to see what technology has been used during the pandemic, whether similar or new concerns were found, and indeed what recommendations are provided for research, policy, and practice in particular.

Emergency remote K-12 education during the COVID-19 pandemic

There has been broad discussion on what to call teaching and learning during these pandemic (and especially lockdown) times (see e.g., Barbour et al., 2020), with 'emergency remote teaching' seeming to be favoured in higher education (Bozkurt & Sharma, 2020b; Hodges et al., 2020), alongside other terms such as 'remote learning' (e.g., Daniel, 2020), 'hybrid learning' (Blume, 2020) and 'digital teaching and learning' (e.g., Association for Learning Technology, 2020a). Ewing and Vu (2020) reported public outcry on Twitter at the use of the term 'home schooling' and, although some parents saw themselves as merely facilitators of learning, resources about distance and online teaching and learning were widely sought after by teachers and parents alike (Cavanaugh & Deweese, 2020).

Reviews that have been conducted so far about the pandemic period have included the impact of school closures on child and adolescent mental health (Nearchou et al., 2020), school closure and management practices (Viner et al., 2020), country reviews on implications for young people (e.g., Darmody et al., 2020), and the impact on vulnerable learners in particular (Drane et al., 2020), although some reviews only include a limited amount of research conducted during the pandemic itself, and tend to have a more medical focus, rather than education. One review has been published so far on teaching and learning in higher education during the pandemic (Butler-Henderson et al., 2020), which identified 138 studies published or available as pre-prints between 1 January 2020 and 30 June 2020, and the protocol for another review focusing on higher education has been registered, which will include research published in English, German and Spanish (Händel et al., 2020). However, from a systematic search of available literature, this represents the first systematic review of K-12 research conducted during the COVID-19 pandemic.

Research Questions

Against this background, in order to help inform policy makers, schools and researchers, the questions this rapid review seeks to answer are:

1. Where, when and by whom has K-12 research on teaching and learning during the COVID-19 pandemic been published?
2. What are the characteristics of, methods used, and topics studied in research on teaching and learning in K-12 during the COVID-19 pandemic?
3. What technology has been used during emergency remote teaching and what are stakeholder perceptions?
4. Which influential factors on student engagement within the microsystem were the most discussed?
5. What recommendations have been provided in the included studies for emergency remote teaching and learning going forward?

Methodology

Due to the emergent and ongoing nature of the COVID-19 pandemic, a rapid review was chosen as the method, over a more extensive systematic review. Following the definition by Hamel et al. (2020, p. 7), "a rapid review is a form of knowledge synthesis that accelerates the process of conducting a traditional systematic review through streamlining or omitting a variety of methods to produce evidence for stakeholders in a resource-efficient manner". This review was undertaken using an explicit and replicable search strategy, with pre-determined inclusion/exclusion criteria (Gough et al., 2012), and following PRISMA reporting guidelines as closely as possible (Page et al., 2020). The PRISMA flow diagram is reported in figure 2. This is also a living rapid review (Elliott et al., 2014), which means that it will be updated regularly with new studies that meet the inclusion criteria, particularly through the use of machine learning via the Microsoft Academic Graph within EPPI-Reviewer[1]. Any new studies found will be uploaded into this review and coded using the coding scheme detailed below. The living review will be available to download from Mendeley Data (Bond, 2021).

It should be noted that, whilst it is recommended that rapid reviews register their protocols as soon as possible (Tricco et al., 2020), the majority of platforms available (e.g., PROSPERO, INPLASY) are health-focused, and whilst the author could have published the protocol on the Open Science Framework, deemed it more pertinent to spend time on doing the research and getting the work out there. The author did, however, seek ethical approval from the Institute of Education at University College London, with approval granted under number REC1420, and in the future will make use of the Open Science Framework.

Search strategy and selection procedure

The initial search was conducted between 17 September and 20 September 2020, and closely followed the strategy of another systematic review currently being undertaken by the author with international colleagues, focused on studies undertaken in higher education during the COVID-19 pandemic, which has been pre-registered (Händel et al., 2020). Given the time constraints involved, the decision was made to limit the number of databases searched, conduct the review alone, and to limit the literature to English language only publications (Tricco et al., 2015). The platforms and databases searched were the Web of Science, Scopus, EBSCOHost, and Microsoft Academic Graph (see Chen, 2020), as well as the COVID-19 living systematic map (EPPI-Centre et al., 2020), which has collated over 70,000 publications relating to the pandemic so far. The Web of Science, Scopus and EBSCOHost are all considered well-suited to evidence synthesis, and they each met necessary requirements in a recent review (Gusenbauer & Haddaway, 2019). A smaller number of studies were also found manually during the life of the review prior to publication (referred to as 'manual searching' in the PRISMA diagram, see Figure 2), through being seen on Twitter for example, or within the COVID-19 research community on ResearchGate[2]. This method of searching grey literature (including pre-print servers) is recommended for any review undertaken around COVID-19, due to the rapidly changing nature of the research landscape and the length of time that the peer review process takes (Tricco et al., 2020).

Search string

The search string (see Table 1) was adapted from Händel et al. (2020) and focused on formal teaching and learning settings during the COVID-19 pandemic (that is, after January 2020) for kindergarten to Year 12 (K-12), using * for truncations. Due to the large number of medical studies that have been published relating to the Corona virus (see EPPI-Centre et al., 2020), medical terms such as 'pathology', 'surgery' and 'inflammation' were added as NOT terms, in order to further refine results.

[1] https://eppi.ioe.ac.uk/cms/Default.aspx?tabid=3754
[2] https://www.researchgate.net/community/COVID-19

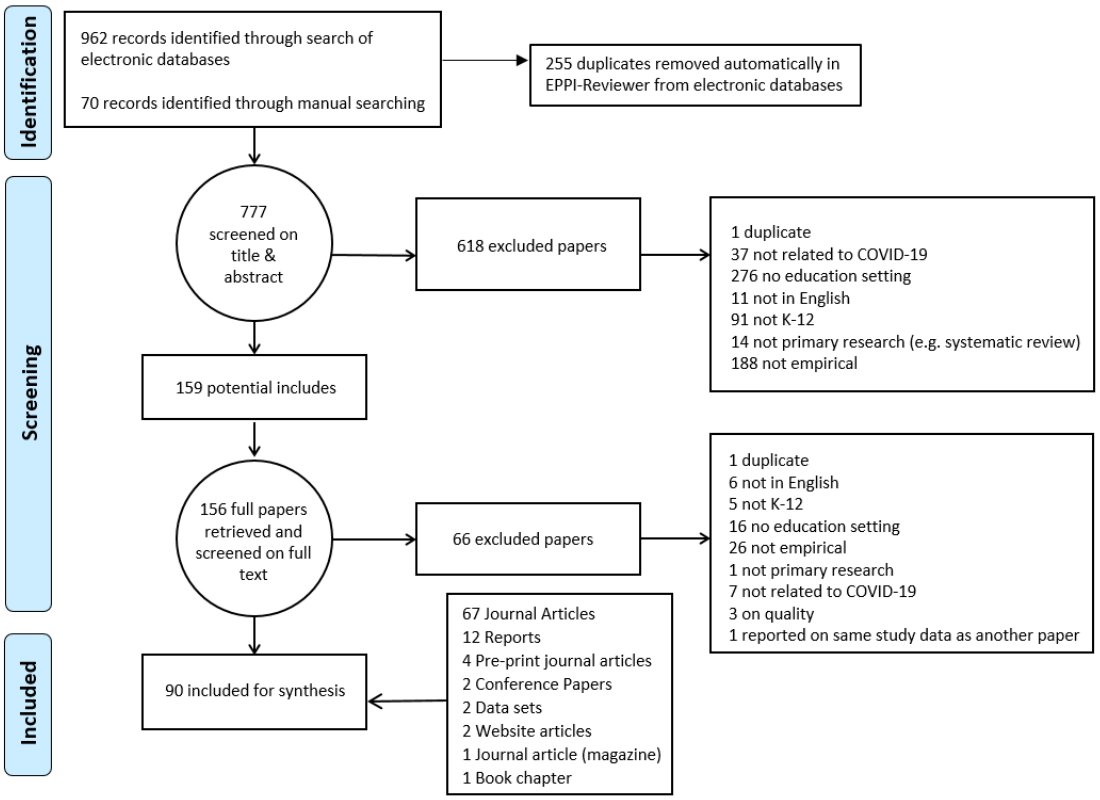

Figure 2. PRISMA diagram

Table 1. Search string

"emergency remote teaching" OR "student-centred remote teaching" OR "emergency remote education" OR "student-centered remote teaching" OR "COVID-19" OR "COVID19" OR pandemic OR "Corona virus" OR "online pivot"
AND
"K-12" OR kindergarten OR kindy OR "primary school" OR "middle school" OR "secondary school" OR school OR "high school" OR "reception" OR "R-12" OR "junior primary" OR "elementary school" OR "middle primary" OR "upper primary" OR "senior school"
NOT
"public health" OR nonpharmaceutical OR energy OR pharmaceutical OR pharmacy OR clinic* OR pathology OR telemedicine OR inflammation OR patient* OR neurolog* OR telehealth OR surgery OR universit* OR "higher education" OR postgrad* OR undergrad* OR "tertiary education" OR college

Inclusion/exclusion criteria

The initial search, and subsequent manual searching, yielded 1,032 records, which were imported into evidence synthesis software EPPI-Reviewer (Thomas et al., 2020). 255 items were then automatically removed using the software's manual deduplication function, leaving 777 items that were screened on title and abstract by the author, applying the inclusion/exclusion criteria (see Table 2). Studies were included if they reported on empirical research, that explored teaching and learning at any stage of schooling during the COVID-19 pandemic (after January 2020). Studies also needed to be published in English, although a number of excellent studies have been published in other languages (e.g., Wößmann et al., 2020).

Studies were excluded if they focused on another education level (e.g., undergraduates), if they did not report on teaching and learning during the pandemic, if they evaluated or merely described a tool, or if they were not empirical research (e.g., editorial). It should be noted that, due to the emergent situation of lockdown, some empirical results were reported in letters to the editor, in order to circumvent standard (and often lengthy) peer review procedures, and so these were included where appropriate. Whilst a quality assessment was not conducted, due to the rapid nature of this review, any studies that did not include clear and explicit details of participants with empirical data were excluded. Altogether, 89 studies

were included for data extraction, from 90 articles[3]. Please note, however, that this is a preliminary analysis of included studies. As this is a living review, further articles will be added in the future, and researchers are encouraged to contact the author to suggest research that should be included. It should be noted that over 40 studies have since been located for inclusion since the writing of this article began, and these will be included in the living review (Bond, 2021).

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
K-12	Higher education, further education
Teaching and learning setting (students, teachers, school leaders, administrative support structures)	No teaching and learning setting
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

Data extraction

In order to extract article data within EPPI-Reviewer (Thomas et al., 2020), the coding system used by Bond (2020b) was slightly modified. Data extraction codes included publication details (e.g., type and name of publication, country of authors), study sample description (e.g., number of participants, country, educational setting), study design (e.g., length) methodology (approach, data collection and analysis), findings (based on the bioecological student engagement model by Bond (2020a)) and recommendations for future ERE. Any technology used were also coded, at both the individual application level, and in categories used by Bond, Buntins et al. (2020), based on Bower's (2016) typology. A full list of the coding scheme is available from ResearchGate[4].

Data synthesis

A narrative synthesis of the data was undertaken (Petticrew & Roberts, 2006), including a tabulation of the studies and their characteristics (see Appendix A). However, as one table is not large enough to clearly summarise the findings, further tables are located throughout the text, or included as appendices. These are then accompanied by a narrative description, summarising the results and recommendations provided.

Interactive evidence gap map development

In order to provide a publicly accessible overview of the studies within this living rapid review as it develops, interactive evidence gap maps were produced, using the application EPPI-Mapper (Digital Solution Foundry & EPPI-Centre, 2020). Data was extracted from EPPI-Reviewer (Thomas et al., 2020) and input into the app, where display and filter choices were chosen[5]. The HTML files were then saved and are available to download from Mendeley Data (Bond, 2021). There are also instructions available on the map, for how other researchers can suggest studies that should be added, which will assist maintain the living review and keep it as up to date as possible.

Computer-assisted content analysis

In order to help answer research question two, and gain further insight into the topics researched so far during the pandemic, the software Leximancer[6] was used. Computer-assisted content analysis has been used within many fields, including educational technology (e.g., Bozkurt, 2020; Marín et al., 2018),

[3] Please note that the study by Trung et al. (2020) reported on the same dataset as Tran et al. (2020)
[4] https://www.researchgate.net/project/Schools-and-emergency-remote-education-during-the-COVID-19-pandemic
[5] Further information about how to create interactive evidence gap maps can be found here: https://youtu.be/hAdXi0tiNa4
[6] https://info.leximancer.com/

psychology (Cretchley et al., 2010), and communication studies (Lin & Lee, 2012), and is considered an efficient and effective method of analysing data (Fisk et al., 2012; Krippendorff, 2013). For the purposes of this study, the titles and abstracts of included articles in the review (n = 90)[7] were converted into a .csv file in Excel and uploaded into Leximancer. Words such as 'during', 'use', 'used' and 'including' were removed, alongside words such as 'results, 'findings' and 'paper', and the words 'school' and 'schools' were merged. Significant concepts and themes were then automatically identified by the software within two sentence blocks, which then produced a concept map (with a theme size of 50%), highlighting the connectedness and frequency of identified concepts (Smith & Humphreys, 2006). The concept map contains a number of key themes - for example 'teachers' - which were automatically produced, depending upon the connectedness and frequency of the words within the data. The map was then analysed by the author, having already read and coded all of the studies in the review, which also included cross-checking between the map and the included studies (Harwood et al., 2015).

Limitations

This rapid review was conducted by one researcher, limited to English-language research and indexed in five databases. Whilst grey literature was also included, as well as repositories such as ResearchGate searched, other valuable research that has been published elsewhere, or in a language other than English, might have been missed. Future reviews should therefore be mindful of Western-biased searches, and researchers are encouraged to contact the author of this review via email, should they have research that can be included, regardless of the language.

Findings and Discussions

Publication characteristics

Of the 90 included articles (see Appendix A), an impressive 88% (n = 79) are available open access, with six articles available open access for six months only. The high number of open access articles may partially be due to strong calls from open science communities for researchers to publish any research related to COVID-19 as open access (e.g., Association for Learning Technology, 2020b; Wellcome Trust, 2020), to ensure that knowledge is openly available to all and help reduce social injustice and inequality (Bozkurt & Sharma, 2020a). Despite concerns that this will heighten global research inequality (Pooley, 2020), this does not seem to be the case in the present review, with the five studies not available open access from the United States (US), the United Kingdom (UK) and Australia.

The studies in the review came from 50 unique publications (see Appendix B), with the most studies (n = 6) published in *Information and Learning Sciences*, who issued a call for a special issue in April 2020, focusing on emergency remote teaching during the pandemic (see Reynolds & Chu, 2020). The remaining articles were reports (13%), conference papers, data sets, website articles and one book chapter (Hunter et al., 2020), which is currently in pre-print. Overall, 74% (n = 67) are peer-reviewed journal articles, a further four pre-print articles have not currently been peer-reviewed, and one article was published in a teacher magazine (Sandvik, 2020), which is only available to members or by purchasing access.

Where, when and by whom were studies published?

The articles in this review were published by 291 different authors, mostly in teams of two (see Table 3), hailing from 39 countries (see Figure 3). The most prevalent country was the US (26% of studies), followed by the UK (12%), Indonesia (8%), Philippines (6%) and Spain (6%). Despite the two most

[7] Please note that the study by Trung et al. (2020) reported on the same dataset as Tran et al. (2020)

prevalent countries being somewhat as expected for research involving educational technology (e.g., Bodily et al., 2019; Bozkurt, 2020), it is pleasing to see a rise of publications from Indonesia and the Philippines. Almost half of the studies in the review came from European authors (44%, *n* = 40), followed by North America (26%) and Asia (24%, *n* = 22), with little representation from Oceania (4%), Africa (3%), the Middle East (3%), or South America (1%); a finding that follows prior K-12 educational technology research (e.g., Bond, 2020b; Pérez-Sanagustín et al., 2017). A particularly interesting finding of this review has been the lack of research from either Taiwan or Turkey; arguably two leaders in the field of educational technology, based on contributions in top journals (Bond et al., 2019; Chen et al., 2019; Zawacki-Richter & Latchem, 2018).

Table 3. Scope of article authorship (*n* = 90)

Number of authors	Frequency	Percentage
1 author	16	18%
2 authors	25	28%
3 authors	11	12%
4 authors	15	17%
5 authors	5	6%
6 authors	6	7%
7 authors	4	4%
8 authors	3	3%
9 authors	1	1%
10 authors	1	1%
11 authors	3	3%

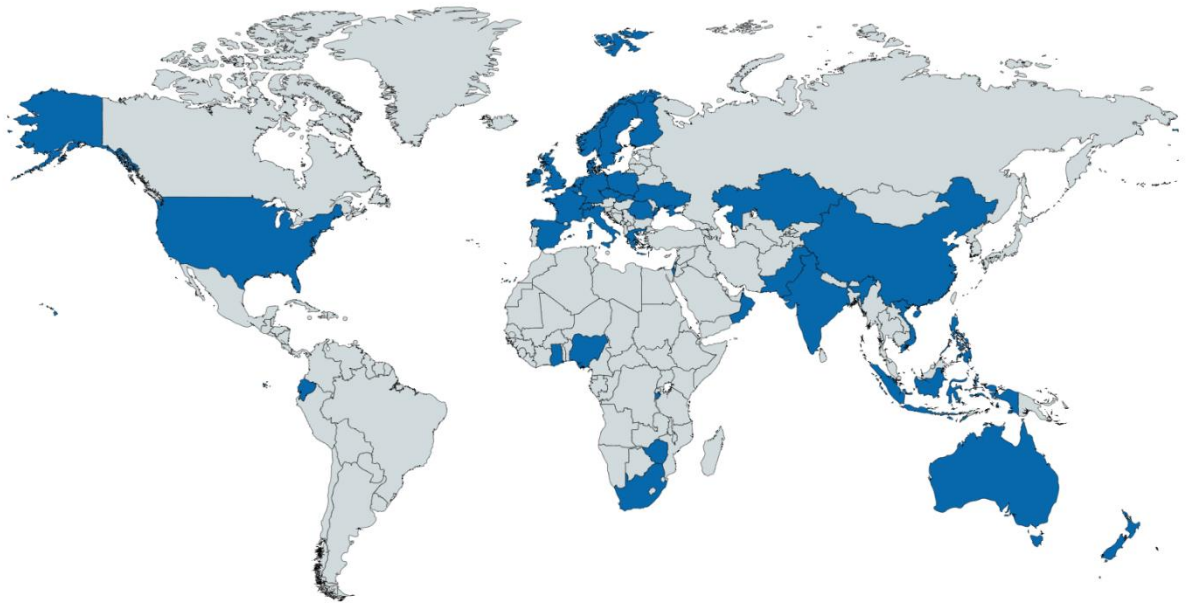

Figure 3. Geographical location of authors, created using https://mapchart.net/world.html

Perhaps unsurprisingly, given the unique lived experiences within each country (see e.g., Bozkurt et al., 2020), the overwhelming majority of studies were domestic collaborations (69%, *n* = 62), with only six studies a combination of domestic and international collaboration, and five studies purely international collaborations. Of these, the study by Gudmundsdottir and Hathaway (2020) was based on a major international study of teachers' experiences during the pandemic (Teachers' Readiness Online study), with this particular article focusing only on those located in Norway and the United States. The OECD report by Reimers and Schleichter (2020) was also an international collaboration that included survey data from teachers, school leaders, administrators and government officials from around the world.

The first wave of publications peaked in June 2020 (see Figure 4), likely due to the initial special issue calls by journals such as *Information and Learning Sciences* and the *Journal of Technology and Teacher Education* (Hartshorne et al., 2020). There was then a reasonably sharp drop-off in numbers in July

2020, after which numbers have started to slowly rise again. The majority of first authors (76%) are from the field of Education, followed by Sociology (6%), Medicine (4%), Psychology (2%), Economics (2%), Computer and Systems Science (2%), Media Studies (2%), and one each from Mathematics and Sport science.

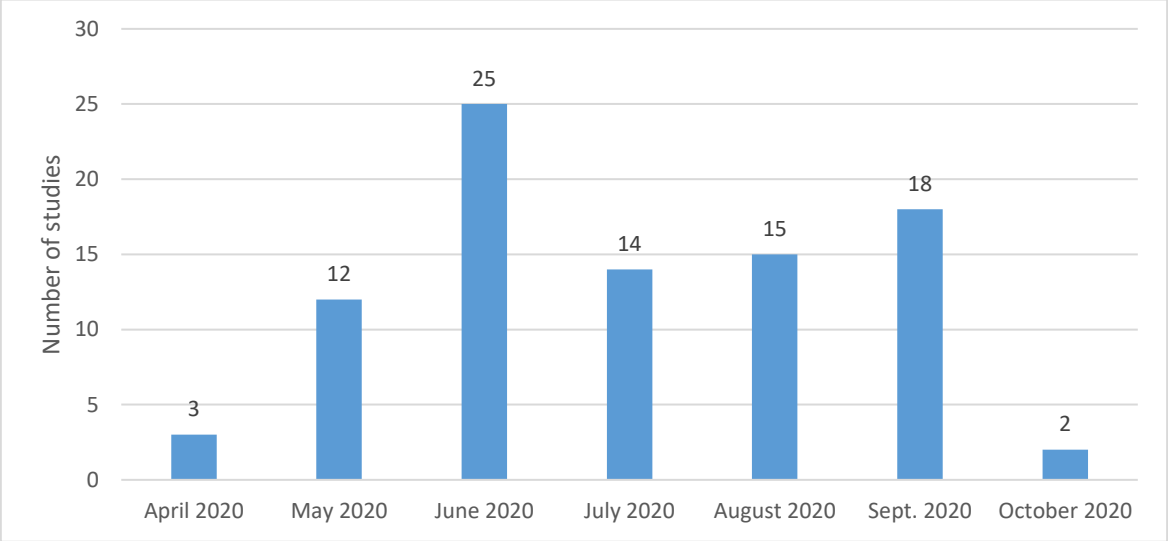

Figure 4. Timeline of study publication

Study characteristics

Given the difference in spread of COVID-19 across the world, it is important to be able to understand when data was collected during the pandemic, although 25 studies did not report this information. Most of the data for studies published so far, were collected in March (27%), April (44%) and May (33%) of this year (see Figure 5). When compared to the dates of study publication, differences in publication speed can be seen, although this arc does not change shape when only non-peer-reviewed journal articles are considered.

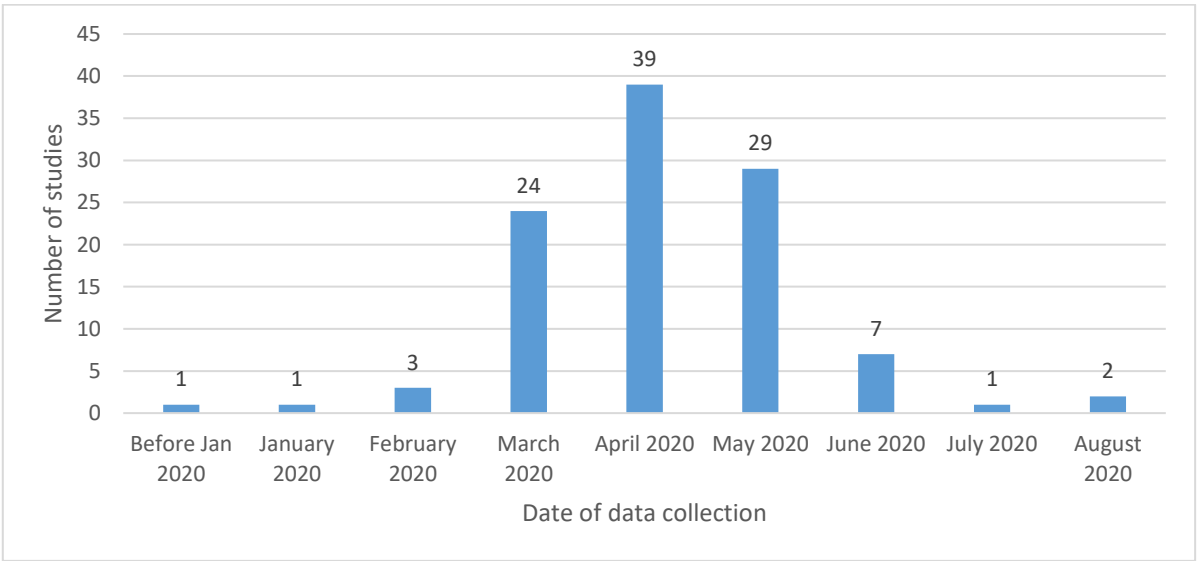

Figure 5. Timeline of data collection

Whilst 32% of studies did not mention study or data collection length, the studies in this review predominantly collected data over less than a month (44%, *n* = 39), with 17% (*n* = 15) conducted between two and three months (see Appendix C). Seven studies had data collection periods of less than one week, for example the study by Riwai-Couch et al. (2020), which surveyed the perceptions of

parents of Māori and Pasifika students in New Zealand, and a large-scale Chinese survey, which explored 15,438 teacher responses to and experiences of the pandemic (Yang, 2020). When cross-tabulated against data collection methods (see Appendix D), studies that were shorter in length generally tended to use online surveys, with more qualitative methods, such as focus groups and interviews, tending to be used in studies of at least two to three weeks in length, although whether these amounts of time included data analysis was unclear in many.

Geographical characteristics

The 89 studies in this review included participants from 70 different countries (see Appendix E), across all major continents (see Figure 6). Most studies were conducted with participants from the US (22%), followed by the UK (12%), Indonesia (10%), Germany (7%), China (6%), the Philippines (6%) and Spain (6%). Similar to study authorship, most research participants were from Europe (44%, *n* = 39), followed by Asia (27%, *n* = 24) and North America (22%, *n* = 20), with very little from Africa (6%), Oceania (4%), the Middle East (4%), or South America (2%).

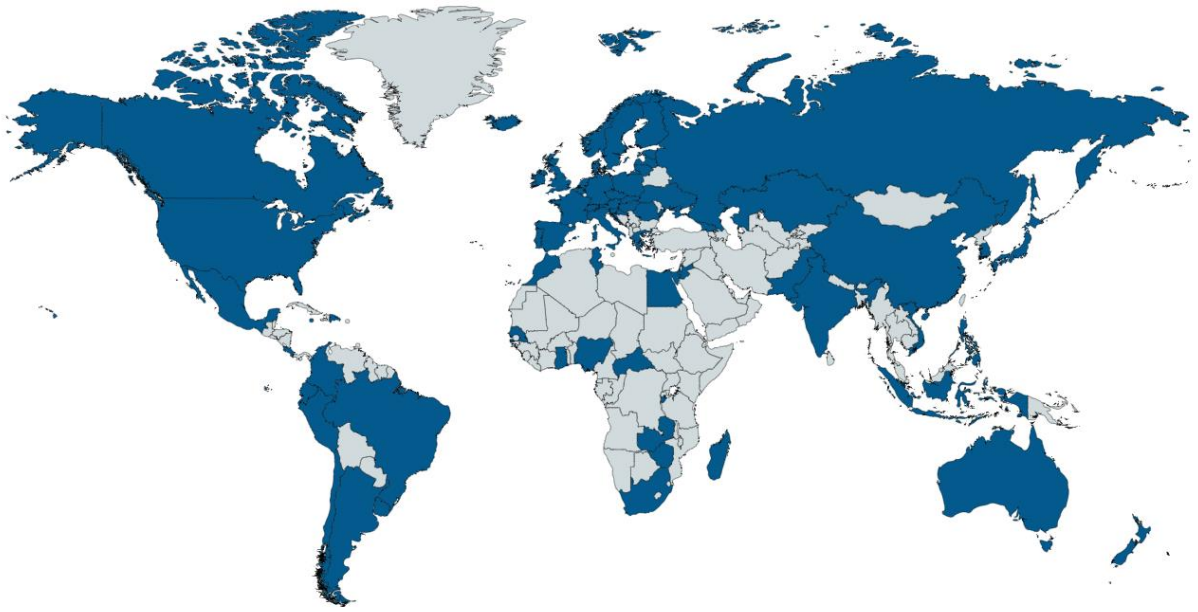

Figure 6. Geographical location of study participants, created using https://mapchart.net/world.html

Sample focus

Most of the articles that have been published so far have focused on the experiences and perceptions of teachers (see Table 4), followed by parents, and students. However, remarkably few studies have triangulated data from multiple sources, such as the study by Bubb and Jones (2020) of teachers (*n* = 151), school leaders (*n* = 15), parents (*n* = 779) and students (*n* = 320 aged 6-9, *n* = 745 aged 10-16) in a Norwegian municipality. Whilst this is likely due to study manageability and wanting to analyse and publish data to help inform research and practice as quickly as possible, this is a recommendation for future research going forward (Kim & Asbury, 2020; Primdahl et al., 2020).

The majority of articles were focused on experiences at the secondary schooling level (78%, see Appendix F), followed by primary schools (62%), and kindergarten (10%), although the level of schooling being reported on was unclear in eight studies. Studies that focused on students followed this pattern (see Appendices G and H), with most studies centred on students in Years 7, 9 and 11 where year levels were reported, or on students aged 11, 12, 15 or 16 years old, where ages were reported, which echoes previous K-12 flipped learning research (Bond, 2020b). There were still six studies, however, that did not report any information as to year level or age of study participants.

Table 4. Participant focus of studies (*n* = 89)

Focus	Frequency	Percentage
Teachers and school leaders	63	71%
Teachers	61	69%
Parents	24	27%
Students	20	22%
School leaders	15	17%
Parents and teachers	6	7%
Parents and students	6	7%
Parents, students and teachers	4	4%
District administrators	3	3%
Learning designers	1	1%
Government officials	1	1%

There were only a handful of studies that focused on specific subject areas (see Appendix I), with the majority of these being STEM subjects, including Chemistry (e.g., Okebukola et al., 2020), Maths (e.g., Mailizar et al., 2020), and ICT (e.g., Ocana et al., 2020).

Methodological characteristics

46 studies (52%) employed qualitative methods, 39 studies (44%) used quantitative methods and 4 studies (4%) used mixed methods, which is quite different to the findings of Bond (2020b). This is due no doubt to the need for alterations to research design, as a result of the conditions imposed by conducting 'emergency remote research' during the pandemic, as well as a desire to gain deeper insight into the experiences of teachers, parents and students through qualitative research, given the unprecedented nature of the pandemic. The most frequently used approach was quantitative non-experimental (42%, *n* = 37), using online surveys for data collection, followed by qualitative studies (24%, *n* = 21) and case studies (16%, *n* = 14).

Given the need for emergency remote research, it is unsurprising that the most frequently used data collection tool were online surveys (67%, *n* = 60), followed by interviews (30%) and focus groups (11%). Whilst conducting interviews online via Skype or other video conferencing software is not a new technique per se (Janghorban et al., 2014), it was surprising to find so many studies had also conducted remote focus groups. An example of a study using focus groups during the pandemic is that by Daley et al. (2020), who conducted two 90-minute focus groups with four teachers via Zoom. Another example is that by Dvir and Schatz-Oppenheimer (2020) with 32 early career teachers in Israel, who conducted two 90-minute Zoom focus groups during a semester induction course.

The majority of online surveys were created by researchers to be fit for purpose, that is, to answer self-developed questions pertaining to experiences and perceptions of the pandemic, which is likely due to their early development (March *n* = 16, April *n* = 33, May *n* = 25). For example, Berasategi et al. (2020) designed and validated a scale for measuring children's well-being during lockdown, aged between 4 and 12 years, and the Teachers' Readiness Online survey was piloted in both English and Norwegian, before being translated into eight further languages. Bhaumik and Priyadarshini (2020) developed a survey to measure the readiness of secondary school students to learn online. They piloted the survey with 20 students, as well as testing for internal consistency using Cronbach's Alpha. Bonal and González (2020) also piloted their survey with 10 families, "due to the exceptional circumstances...using an informal strategy" (p. 8). A number of studies (e.g., Brom et al., 2020) also mentioned trying to keep surveys brief, so as not to further burden families and students.

Qualitative content analysis was the most used data analysis method (46%, *n* = 41), with thematic analysis (Braun & Clarke, 2013) and grounded theory (Strauss & Corbin, 1994) frequently used, followed by descriptive statistics (40%, *n* = 36). Inferential statistics were used in 19 studies (21%), with network analysis used to explore institutional and teacher responses to the pandemic in an Italian study (Giovannella et al., 2020). However, 25 studies (28%) did not explicitly detail how they were analysing

their data. This may also relate in some part to the lack of theoretical frameworks used, with only 38% being explicitly guided by one, such as TPACK (Mishra & Koehler, 2006) as used by König, Jäger-Biela and Glutsch (2020), and self-efficacy, as used by Baloran and Hernan (2020). The lack of theoretical guidance in educational technology literature has recently become a matter of increased discussion (e.g., Hew et al., 2019), as has the need for more accurate reporting of study design (e.g., Bond, 2020b). Framing research in a strong theoretical base not only assists with the interpretation of data (Kaliisa & Picard, 2017), but also with redefining the view of a field (Crook, 2019; McDonald & Yanchar, 2020).

Terminology used about research on teaching and learning during the pandemic

In order to explore whether the terms describing teaching and learning during the pandemic favoured by higher education (e.g., emergency remote education) had transported to the K-12 level, any terms that were used often to describe teaching and learning within articles were coded (e.g., within the keywords and research questions).

The two most frequently used terms in the K-12 literature (*n* = 90, see Figure 7), which also echoes the concept map (see Figure 8), were 'distance learning' and 'online learning'. These terms were used by 20 unique studies each, comprising almost half of the corpus (44%). 'Distance learning' was paired with 'distance teaching' or 'distance education' twice, as well as with 'remote learning' twice. 'Online learning' was paired with 'online teaching' (*n* = 6), which was also the next most frequently used term, as well as 'online education' and 'remote learning' twice. Interestingly, 'emergency remote teaching' was only referred to in 10 studies, with five of these published in June 2020. This indicates that the phrase was not as widely accepted within the K-12 research community, as it was in higher education. These results may also support the concern that any ERE undertaken during the pandemic, either effective or ineffective, will be associated with (and potentially harming) the field of distance and online learning for some time to come (Bozkurt & Sharma, 2020a; Daniel, 2020).

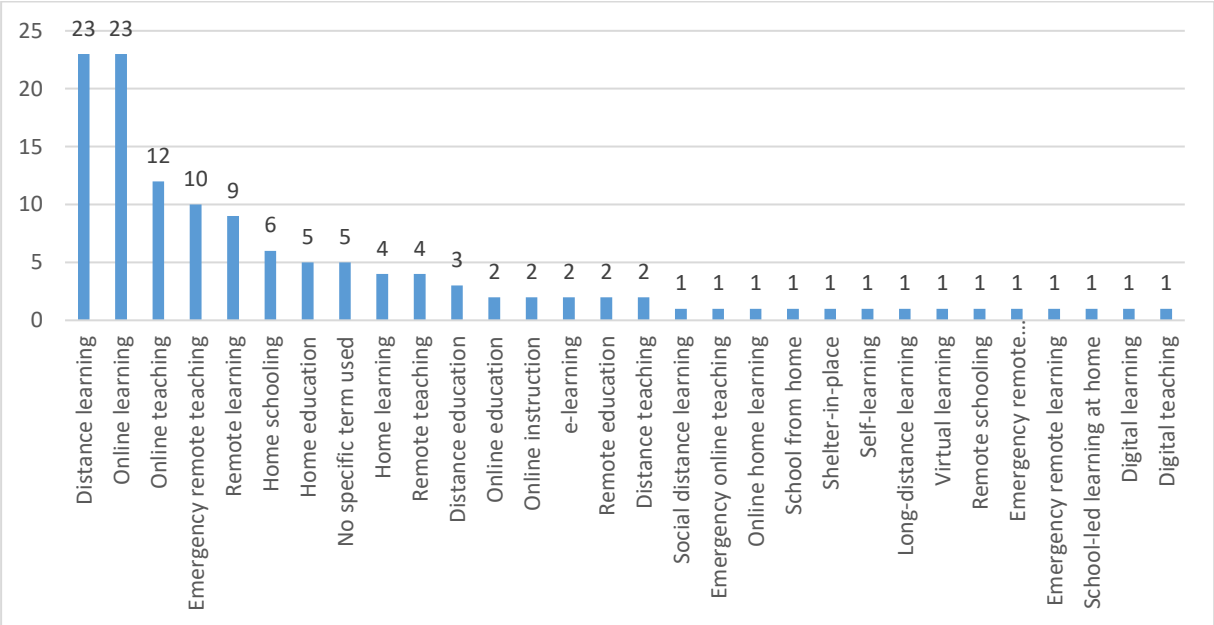

Figure 7. Terminology used to describe teaching and learning during the pandemic

Study focus

The articles that have been published so far have predominantly focused on the general challenges faced in teaching and learning as a result of the pandemic (see Table 5), followed by teacher digital competencies and digital infrastructure. Surprisingly, little research has focused on student (*n* = 15) and teacher well-being (*n* = 4) explicitly, or on special needs (*n* = 9) and migrant students (*n* = 2), although now that more validated scales are available on these topics (e.g., child well-being, Berasategi et al.,

2020), we may see an increase in research in these areas in the coming months. Studies focusing on students with special needs have predominantly come from Europe (see Appendix K) and have included strategies for parents home educating students with Autism (Cahapay, 2020; Majoko & Dudu, 2020). Studies have also focused on how students with Attention Deficit Hyperactivity Disorder have experienced the pandemic (Bobo et al., 2020), as well as how children with disabilities and their families are being supported (Toseeb et al., 2020).

Table 5. Topic focus of studies (*n* = 90)

Areas of Focus	Frequency	Percentage
General challenges	57	63%
Teacher digital competence	30	33%
Digital infrastructure	30	33%
Student learning habits	29	32%
School/home connection	28	31%

In order to gain further insight into the topics explored within the 90 articles in this review, a concept map was produced using Leximancer (see Figure 8), a computer-assisted content analysis software. The thematic summary reveals that *school* has the most direct mentions in the data with 235 (100% relative count), followed by *learning* (82% connectivity), *teachers* (72%), *parents* (34%), *lockdown* (15%), *secondary* (10%) and *activities* (9%). This map indicates that research has heavily focused on the impact of lockdown and the COVID-19 pandemic on schools and learning, but particularly on the challenges experienced by teachers as a result of switching to online forms of teaching and learning (see *challenges-teachers-experiences-online-learning* and *teachers-experiences-online-digital*). The map also supports the finding that more of the research has been focused on the secondary schooling level (see *teachers-teaching-remote-study-secondary*), and that research has explored how families have supported children at home (see *children-home-parents-time-activities* and *online-learning-social-families-time-activities*). This could also suggest that K-12 ERE has particularly focused on activity-based strategies. The map further reveals that research has sought to understand the experiences of students during the pandemic (see *students-online-experiences* and *students-online-learning-support*), as well as the opportunities that technology can offer to support learning (see *students-online-learning-technology-opportunities*).

Whilst not solely focused on K-12 research, the review of research published in the *British Journal of Educational Technology* by Bond et al. (2019) contrasts quite substantially with the results obtained here. In a concept map of articles published between 2010 and 2018 (*n* = 712), produced using the same software, the focus was on the learning processes of students, through the use of educational technology. *Learning* had the most direct mentions (100% relative count), followed by *students* (75%), *technology* (35%), *analysis* (14%), *performance* (11%) and *model* (10%). Further exploration is invited into how concepts and topics have changed between K-12 distance learning and ERE literature, as well as a shift in focus for future ERE research, back to students and learning.

Technology use and perceptions

The technology mentioned in studies were coded both on individual applications, as well as the broader category they are classified against, according to the typology used by Bond, Buntins et al. (2020), based on Bower (2016). Across the 90 articles, over 80 individual educational technology tools were used (see Appendix L), although unfortunately not every study indicated the exact technology used. The top five most frequently researched or mentioned tools were Zoom (*n* = 26), Google Classroom (*n* = 19), other un-named LMS (*n* = 17), videos made by teachers (*n* = 14), and other un-named video conferencing software (*n* = 12). The top five categories, according to the tool typology employed, were *synchronous collaboration tools* (*n* = 42, 47%), *knowledge organisation and sharing tools* (*n* = 39), *text-based tools* (n = 34), *multimodal production tools* (*n* = 26), and *social networking tools* (*n* = 11). Whilst not part of the typology, textbooks and other printed materials were mentioned 17 times, which reduced equity issues and reliance on digital access (Bagoly-Simo et al., 2020), and was a particular priority in areas of disadvantage (Moss et al., 2020).

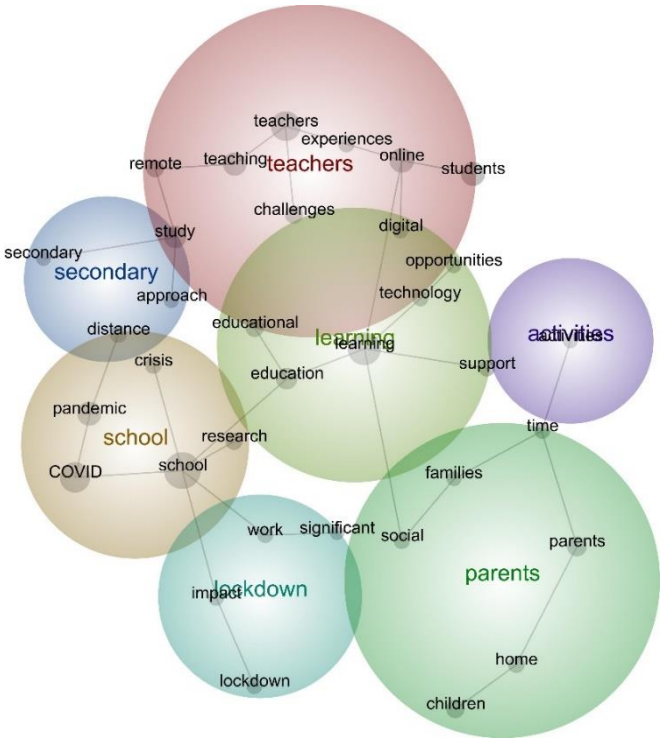

Figure 8. Concept map of studies (*n* = 90)

Zoom video conferencing software was used in a number of ways, including to conduct online drop-in office hours (Peterson et al., 2020), which were informal spaces for students and teachers to interact, daily morning class meetings (Kraft et al., 2020), the use of breakout rooms to facilitate small group work (Kaden, 2020), and having students draw annotations (Kelley, 2020). However, the use of Zoom also posed challenges, such as a lack of 'netiquette' amongst students (Bergdahl & Nouri, 2020), instances of racism (Dvir & Schatz-Oppenheimer, 2020), the security scare of both Zoom-bombing and issues of privacy (Daley et al., 2020; Sandvik, 2020), and the amount of time it took to organise them for teachers (Primdahl et al., 2020). Some teachers also reported Zoom logging them off after 40 minutes, after which time some students would not log back in for the completion of lessons (Okebukola et al., 2020), as well as 'Zoom fatigue' (Riwai-Couch et al., 2020). There is also the issue of equity where, despite the opportunities for interaction and the benefits of human contact that video conferencing provides, students from lower-income families may not have access to devices (Burns, 2020), or their schools may not have the facilities either (Andrew et al., 2020).

Google Classroom was found to be the most used technology in Australia and New Zealand in a study of over 3,500 teachers and school leaders (Flack et al., 2020). The benefits of Google Classroom mentioned in the studies included the ease of accessibility to the app, either via a device or online (Atmojo & Nugroho, 2020), the ability to organise and keep track of work (Bhaumik & Priyadarshini, 2020), and the ability for students to comment on each other's work (Ng et al., 2020). One difficulty mentioned with this particular platform, was trouble with the news feed mixing submissions and messages from various classes, which affected the ability to separate and address student and parent needs (Daley et al., 2020).

As with previous reviews of studies using the flipped learning approach (Bond, 2020b; Lo et al., 2017), videos made by students' own teachers were more popular than the use of videos made by others, although the UK study of over 1000 senior leaders by Lucas et al. (2020) found that secondary leaders were significantly more likely than those in primary schools to indicate that their teachers were recording videos for students (55% to 42%). Teachers created instructional videos of scientific experiments (e.g., Babinčáková & Bernard, 2020), how to use certain applications (e.g., Clausen et al., 2020), and instructions of what work to complete for the week (e.g., Lambert & Schuck, 2020). Some teachers also

worked in small groups in order to take turns to prepare videos and materials for students studying the same subject (Ng et al., 2020), which eased some of the burden and reduced preparation time.

Exploration of research within the microsystem

The articles were also coded against the Bioecological Model of Student Engagement (Bond, 2020b; Bond & Bedenlier, 2019), in order to see which particular aspects of the microsystem were the most discussed during the pandemic, and what stakeholder perceptions were. With the heavy focus on teachers, as well as the experiences of parents and students found within the studies in this review, it was unsurprising that the influential factors of Teacher (*n* = 73 studies), Family (*n* = 70) and Student (*n* = 70) were the most mentioned, followed by School (*n* = 52), Curriculum (*n* = 40), Learning environment (*n* = 38) and Peers (*n* = 25).

Teacher

The themes that emerged through the literature, around teacher influential factors on teaching and learning (see Figure 9 and Appendix M), were substantially more in number than had previously been found in research on K-12 student engagement and educational technology (e.g., Bond, 2020b). The most frequently discussed factor was teacher ICT skills and knowledge (37%), with studies understandably reporting that those teachers who already had a range of digital competencies prior to the pandemic, were in less stressful positions than those who did not (e.g., Peterson et al., 2020). However, studies also reported that even experienced teachers struggled with making the switch to remote online learning (e.g., Putri et al., 2020), not just in terms of understanding how various platforms and applications work (Rap et al., 2020), but also how to use them in pedagogically effective ways (Trust & Whalen, 2020).

The second most frequent factor was the amount of support provided by teachers (32%), with a number of studies reporting that further support and connection was needed by students (e.g., Larcher et al., 2020). However, there were also many studies detailing how teachers were going above and beyond, trying to ensure that student friendships and familial support networks continued to be strong (e.g., Moss et al., 2020; Roca et al., 2020), with some teachers offering individual support through instant messaging (Ng et al., 2020) or group chats (Lansangan, 2020). This meant, however, that teachers have been working extraordinarily long hours, on top of marking and preparation, which is associated with declined teacher well-being (Jerrim, 2020).

Family

There are many familial factors influencing teaching and learning (see Figure 10 and Appendix N), with access to technology and devices the most prevalent in more than half of these studies (54%), followed very closely by parental involvement in and engagement with learning (53%). In a US study of over 1000 parents (NortonLifeLock, 2020), roughly 3 out of 10 parents have purchased a new device for their child as a result of the pandemic, particularly handheld devices such as tablets. However, many households were not in a position to be able to afford to buy new equipment, or even fix old ones (Popyk, 2020), and some families were unable to provide designated learning spaces in their homes (e.g., Parczewska, 2020). Poor internet connectivity, lack of internet quota to cover the whole family, and general technical issues also impacted on the ability of students to participate in ERE (e.g., Race, 2020).

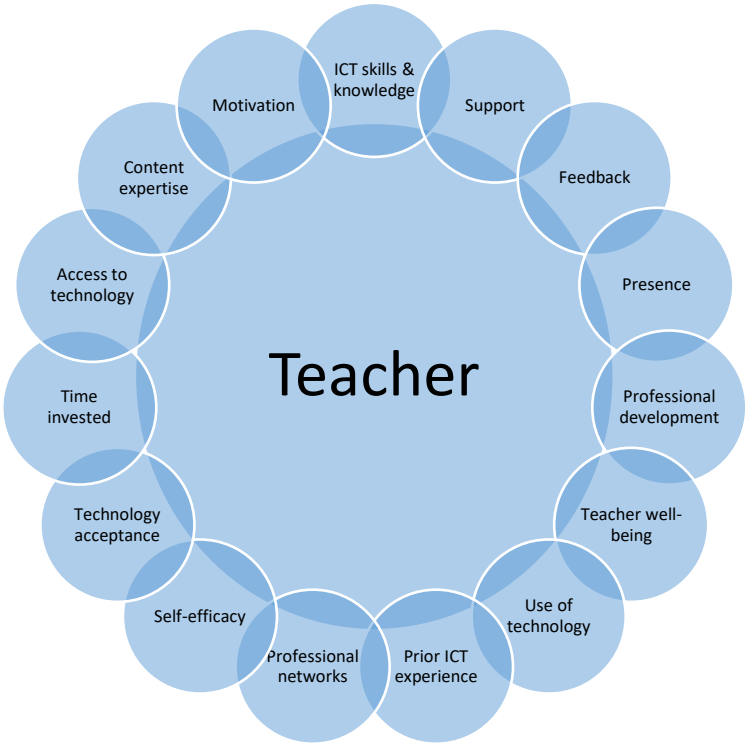

Figure 9. Teacher influences on teaching and learning (*n* = 73)

As the ICT skills of younger primary school students are not quite developed enough to be independent learners, the onus was placed on families to be present and healthy (Anderson & Hira, 2020), despite increases in anxiety and stress (Letzel et al., 2020; Zhao et al., 2020). A UK study of almost 2,500 households (Eivers et al., 2020) revealed that, whilst parent support was indeed highest in the primary level, parents in the lowest-income group spent slightly more time providing support than those in higher income groups. Some teachers have found this increased engagement in children's learning an opportunity to form stronger relationships with parents (e.g., Whittle et al., 2020), just as some parents have enjoyed the enhanced insight into their children's schoolwork (e.g., Roe et al., 2020). However, some schools reported instances of families becoming so frustrated by the number of calls from teachers, that they started blocking the school phone number and refusing to communicate (Brelsford et al., 2020). This indicates that schools may need to reconsider their communication strategy, and not only tap into the wide range of technology that can assist (e.g., emails, discussion forums, social media), but also to consult with families over their preferred methods of communication.

Student

Of the 11 various student influences on learning identified within the studies (see Figure 11 and Appendix O), student health and well-being was the most dominant (43%). Given the lack of one-to-one interaction with students, teachers have been particularly concerned about their ability to monitor students' well-being (van der Spoel et al., 2020), with some students finding the isolation too difficult to bare (Wong & Moorhouse, 2020). Whilst some students felt that remote learning allowed them increased freedom to study and exercise when they wanted to (Letzel et al., 2020; Niemi & Kousa, 2020), a study of over 4,500 Norwegian parents found that 23% of students in lower secondary grades were being physically active for less than 15 minutes of school day (Roe et al., 2020). Studies in this review, particularly in regards to SEND students, also found quite divergent responses (e.g., Asbury et al., 2020; Bobo et al., 2020), with some students experiencing reduced anxiety and improved self-esteem as a result of less school-related stress, and others exhibiting increased opposition, emotional outbursts and sleep issues, which all impacted on their learning.

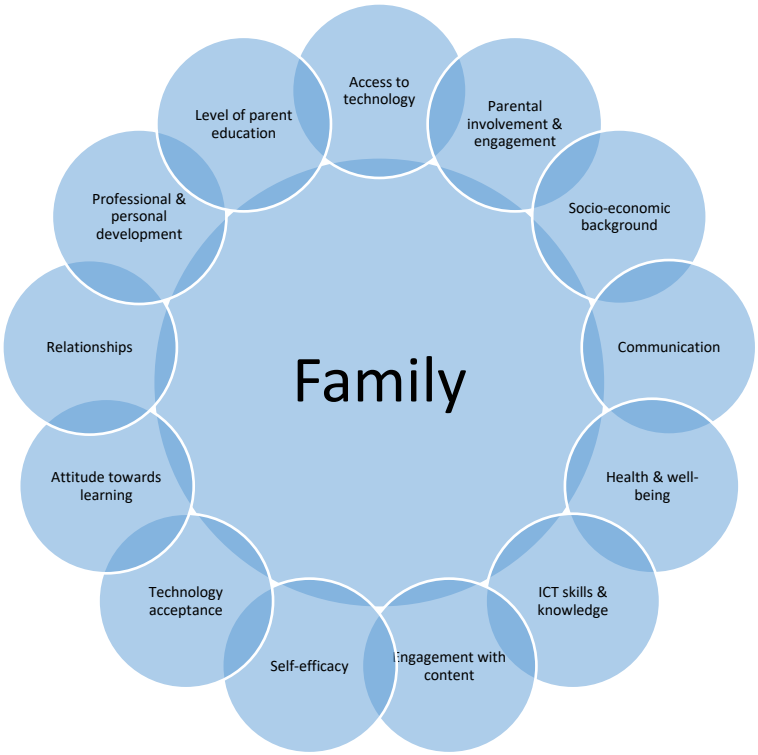

Figure 10. Familial influences on teaching and learning (*n* = 70)

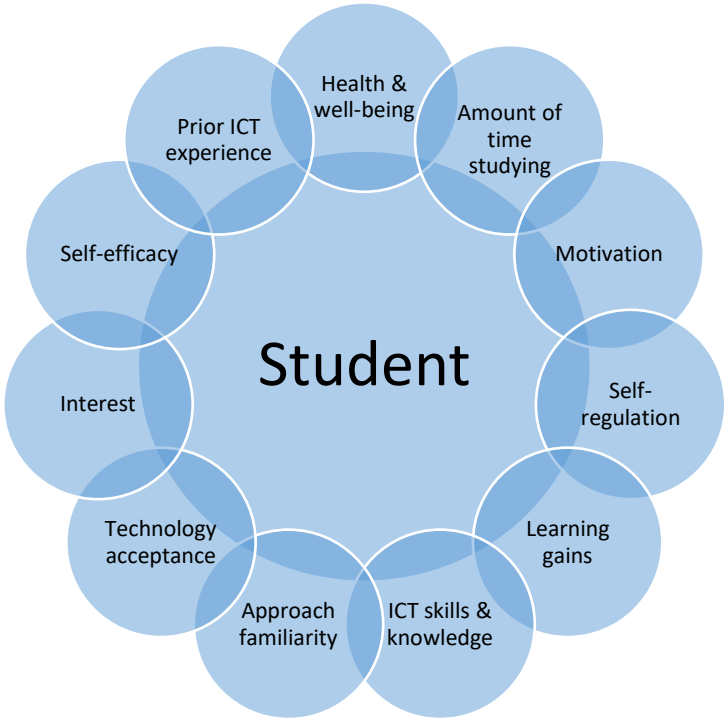

Figure 11. Student influences on teaching and learning (*n* = 70)

A number of studies (e.g., Huber & Helm, 2020) reported that a large amount of students were spending less than two hours a day studying, with students from lower socio-economic backgrounds less likely to be completing and returning work (e.g., Eivers et al., 2020; Moss et al., 2020). Students who indicated that they were doing less work than usual found it easier to learn at school, where they felt they had more access to the support of their teachers (Babinčáková & Bernard, 2020), with some students feeling overwhelmed by the amount of work set (e.g., Popyk, 2020), lacking motivation once exams had been

cancelled (Turner et al., 2020), or missing the social presence of schooling in general (Pietro & Madonna, 2020; Whittle et al., 2020). In contrast, there were some students who thrived under the opportunity to take ownership of their learning (Bubb & Jones, 2020), although further development of self-regulation skills was called for in many studies (e.g., Sulisworo et al., 2020).

Interestingly, only 17% of studies mentioned student ICT skills and knowledge, although overwhelmingly they reported a lack of digital awareness of a range of platforms, alongside a lack of self-organisation, especially in regards to login information (e.g., Primdahl et al., 2020). Primary school children were particularly in need of technical guidance, which placed further stress on family life (e.g., Flack et al., 2020).

School

Schools were ready and willing to respond to the challenges of the pandemic (see Figure 12 and Appendix P), including ensuring that students had work to go on with in a hurry (e.g., Hunter et al., 2020) and evolving their technology policies (e.g., Vu et al., 2020). However, some were not equipped with the necessary infrastructure to support the switch to ERE, or were hampered by pre-existing policies, such as the GDPR in Europe (Bergdahl & Nouri, 2020) or the ban on mobile devices in Romania (Santi et al., 2020). There were also issues of communication from district level when devices had been acquired, as well as instances of schools holding onto equipment unless families specifically requested them (Brelsford et al., 2020). In some cases, schools delivered WiFi hotspots to students without internet at home (Kaden, 2020), or organised for WiFi to be available in school car parks (Kraft et al., 2020). However, internet connectivity and access remain a serious issue in many countries and rural areas (Molise & Dube, 2020; Okebukola et al., 2020), and therefore some governments chose to invest in educational television services instead (e.g., Rasmitadila et al., 2020).

Whilst some studies reported that school leadership had provided increased support to staff (e.g., Crick et al., 2020), including through expert technical assistance (e.g., Lansangan, 2020), there were also instances of principals not checking in with their teachers to offer support at all (Aguliera & Nightengale-Lee, 2020). In a study of almost 6,000 teachers in the US, teachers were found to experience a greater sense of success in schools where there was strong communication, fair expectations, recognition from leadership, collaboration with colleagues, and targeted professional development (Kraft et al., 2020). Mixed messages from Departments of Education and at the district level caused confusion, with a need for clearer government direction and eased curriculum regulations called for (e.g., Kim & Asbury, 2020). Communication with families and students is also key, with more effective strategies deemed to include telephone calls and emails (Lucas et al., 2020), but also the use of WhatsApp messaging (Arlinwibowo et al., 2020), school LMS (Dempsey & Burke, 2020), and social media (Brelsford et al., 2020).

Curriculum

The design of learning activities was the most discussed factor within ‘Curriculum’ (34%, see Figure 13 and Appendix Q), with many teachers exploring alternative tasks, particularly in cases where experiments or hands-on activities were needed. Popular methods included asking students to take photos or make videos, explaining their thinking (e.g., Hunter et al., 2020), carrying out independent projects (e.g., Lucas et al., 2020), and re-writing activities to include home-based ingredients or equipment (e.g., Kelley, 2020). However, some governments forbade conducting experiments at home (Rap et al., 2020), which led to the increased use of videos and heightened teacher frustration (Flack et al., 2020). There was also the issue of trying to adapt and complete the amount of work usually expected, which in some cases ended up with more work being assigned (Sintema, 2020), and a lack of consideration of the need for differentiation (Bobo et al., 2020; Letzel et al., 2020).

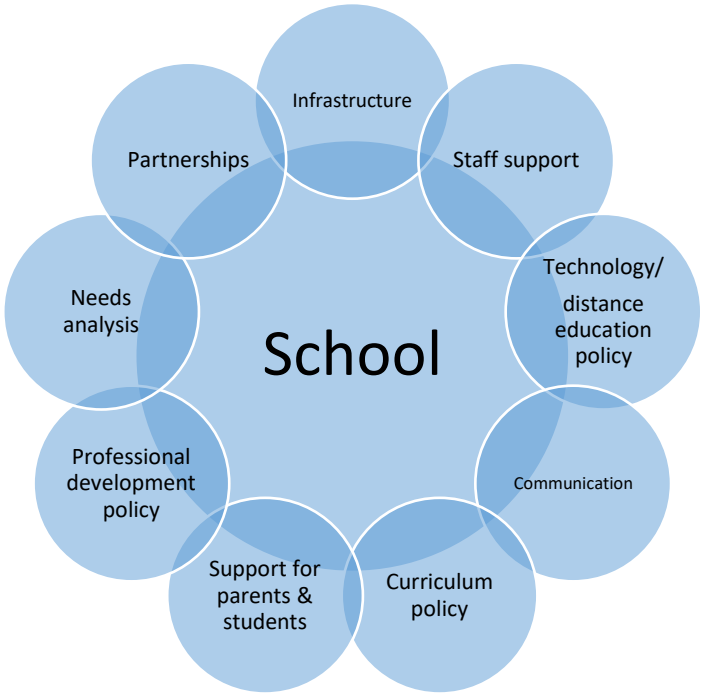

Figure 12. Institutional influences on teaching and learning (*n* = 52)

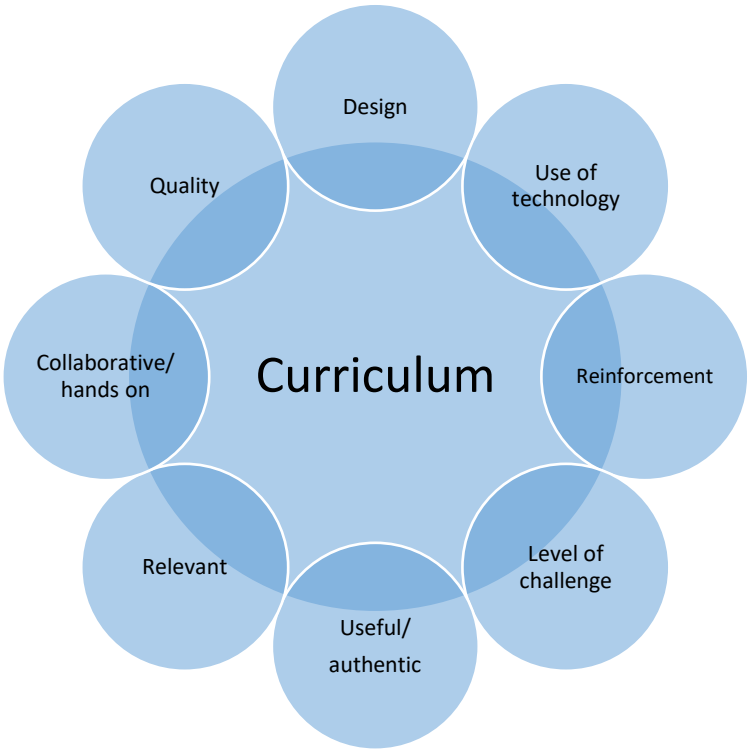

Figure 13. Curricular influences on teaching and learning (*n* = 40)

Learning environment

Linked to 'Curriculum', assessment was the most discussed factor within 'Learning environment and technology' (24%, see Figure 14 and Appendix R). Studies found that both teachers and students had concerns about cheating when using online assessment (e.g., Flack et al., 2020), with some countries banning online assessment altogether (Okebukola et al., 2020). However, teachers also found creative ways to conduct both summative and formative assessment using technology, including student videos,

teachers providing recorded feedback on annotated assignments, using Kahoot to provide quick snapshots of understanding, and breakout rooms in Zoom to conduct small group and individual assessments (e.g., Kaden, 2020).

Usability and accessibility are both incredibly important when it comes to online learning. Being able to login to one platform, instead of multiple applications, streamlined processes for some (Lambert & Schuck, 2020), although issues of age appropriateness, non-intuitive software and apps that would not work on certain devices provided headaches for others (e.g., Riwai-Couch et al., 2020). One solution, to avoid having to create multiple video conferences, was to use one webinar room and have teachers take it in turns to use it (Torrau, 2020). This could, however, bring concerns of students from other classes joining unnecessarily and interrupting.

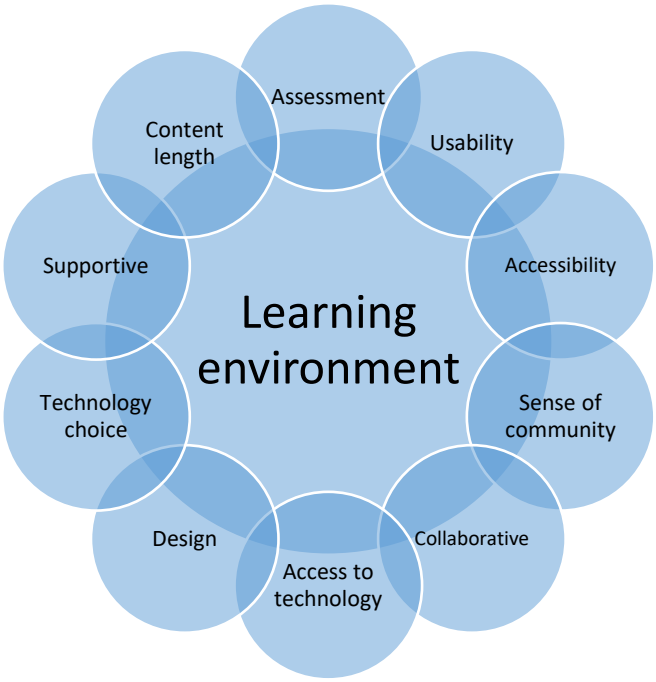

Figure 14. Learning environment influences on teaching and learning (*n* = 38)

Peers

Tied in with the need for social presence and interaction, and linked with student engagement (Bond, 2020b), opportunities to collaborate with peers was mentioned in 26% of studies (see Figure 15 and Appendix S). Parents and teachers were particularly concerned about the impact of this on student well-being (e.g., van der Spoel et al., 2020). In order to facilitate this, some teachers used breakout rooms in Zoom for small group discussions (e.g., Hunter et al., 2020), as well as asynchronous collaboration on discussion forums, such as Edmodo (Ng et al., 2020), and in Google Slides (Lambert & Schuck, 2020). Some studies reported that online group work was not particularly effective, however pair assignments had worked quite well (Niemi & Kousa, 2020).

Recommendations from research during the COVID-19 pandemic

Recommendations for various education stakeholders were made by the authors of articles in this review, which will now be discussed in turn. Whilst tables of all suggestions are provided in the appendices, recommendations that were mentioned within the top five will be summarised here.

Figure 15. Peer influences on teaching and learning (*n* = 25)

Recommendations for Departments of Education

18 studies (20%) provided recommendations for Departments of Education (see Table 6 and Appendix T), with providing further funding for equipment and professional development the most mentioned (*n* = 9), in aide of addressing the digital divide (Du Preez & Le Grange, 2020; Lai & Widmar, 2020). Support in providing staff with training on how to teach via distance and online learning was identified as a key need (Hamilton et al., 2020; Zhang, 2020), especially for rural teachers and those from lower socio-economic areas (Molise & Dube, 2020; Okebukola et al., 2020), alongside training in how to use specific technology and how to monitor student progress online (Rasmitadila et al., 2020). Huber and Helm (2020) point out, however, that some policies and "certain administrative bureaucratic barriers" (p. 251) have prevented easy access to resources during the pandemic, and therefore recommend urgent action be taken, especially in light of many countries now going into second, or even third, national lockdowns (BBC News, 2020a). The difficulties over providing access to laptops for students in the UK, for example, has been an ongoing saga. The government initially offered laptops and a number of 4G internet routers to support disadvantaged students in April (Coughlan, 2020a), however much of the promised equipment never turned up, and laptop allocations for some schools has now been cut by 80% (BBC News, 2020b).

Table 6. Top five recommendations for Departments of Education

Areas of Focus	Frequency	Percentage
Provide further funding for PD & equipment	9	10%
Provide further funding in areas of disadvantage	4	4%
Improve information dissemination	3	3%
Support OER development	3	3%
Take disadvantage into consideration	3	3%

Four studies stressed the need for further funding particularly for disadvantaged students, with Lucas, Nelson and Sims (2020) calling on the UK government to fund any young people who lack access to digital devices, rather than solely targeting specific year levels. However, the report by Dempsey and Burke (2020) indicates that it is precisely those bureaucratic barriers mentioned earlier that might be prohibiting schools from accessing support, with a call for more streamlined processes. This also extends to more effective information dissemination by governments to schools (Baloran & Hernan, 2020; Kim & Asbury, 2020), and Moss et al. (2020) suggested that widening funding to a variety of children's services, might also enable them to better work together. Studies also suggested that further funding be made by governments towards establishing online educational resources, aligned to national

curricula (Hamilton et al., 2020; Ng et al., 2020; Rasmitadila et al., 2020), which would help ease the burden somewhat on schools and teachers.

Recommendations for schools

50 studies (56%) provided 31 different recommendations for schools (see Table 7 and Appendix U). The most frequently mentioned by far (*n* = 28) was the need to provide increased professional development for staff, which was strongest felt in Asia (*n* = 12), followed by Europe (*n* = 8) and North America (*n* = 7). Providing teaching staff with opportunities to further develop their digital technical competencies, as well as their understanding of distance and online pedagogies, featured heavily (e.g., Atmojo & Nugroho, 2020; Bhaumik & Priyadarshini, 2020), with suggestions for training specifically in whole class and individual assessment (Zhang, 2020), video creation and editing, as well as using virtual learning environments effectively (Lucas et al., 2020). Trust and Whalen (2020) suggested that mentoring and online forums could be used, to enable informal professional networks to form, which would strengthen skills and knowledge, alongside strengthening support structures.

Table 7. Top five recommendations for schools

Areas of Focus	Frequency	Percentage
Provide professional development	28	31%
Prioritise equity	13	14%
Provide internet access/invest in infrastructure	13	14%
Develop blended learning competency	9	10%
Provide increased staff support	8	9%

Professional development was also suggested in regards to developing communication strategies between schools and families (Clausen et al., 2020), as well as training for parents themselves, especially those parents for whom English is not their first language (Lucas et al., 2020), or for those who need more advice in supporting the mental health of their children (Asbury et al., 2020). A combination of both training in using technology, as well as how to support their childrens' learning at home is recommended (Novianti & Garzia, 2020), so that they can "feel adequately resourced and prepared to help their children with learning" (Riwai-Couch et al., 2020, p. 39). An example of this is a family literacy programme in the United States that switched to emergency remote teaching as a result of the pandemic (Kaiper-Marquez et al., 2020)[8], which identified a definite need to include deliberate digital literacy skill development as a component of future iterations of the course.

The next two most recommended items of action for schools (14% of studies each) were for greater investment in technology and internet access for both staff and students, and the need for schools to prioritise equity. Vulnerable populations identified in studies included students from lower-income families (Kim & Padilla, 2020), students with special needs (Letzel et al., 2020), academically at-risk students (Kelley, 2020), as well as primary-aged students (Flack et al., 2020), given the need for greater self-direction when learning remotely. Ahlström et al. (2020) stress the need for leaders to look at unequal power relations within their school communities, and researchers called for greater understanding by governing bodies, policy makers and external assessment bodies (e.g., Ofsted in the UK), given the many and varied impacting factors on children's learning, especially during these extraordinary times (Kraft et al., 2020; Moss et al., 2020).

Practical suggestions for helping make remote learning more equitable included providing books with food deliveries to students, without the expectation of having them returned (Burns, 2020), having a printed pack with all learning materials delivered each week (Kim & Padilla, 2020), as well as stationery (Riwai-Couch et al., 2020), and providing social stories such as picture flashcards with explanations of what is happening, to help explain the pandemic situation to students with special needs (Toseeb et al.,

[8] Unfortunately, this study was not included as part of the review corpus reported here, as it was found after the writing of this article had well and truly begun. It will, however, be included in future iterations of the map.

2020). Suggestions for schools in terms of technology access included providing staff with laptops or other devices, so that teachers are not having to use their own resources (Lucas et al., 2020), providing students with internet connection vouchers or dongles (Mailizar et al., 2020), and providing families with (access to) printers or devices for the lockdown period (Riwai-Couch et al., 2020).

Increased support of staff was also recommended (9%), given that "their mental, emotional and academic lift is like nothing they have endured before" (Peterson et al., 2020, p. 467). Studies called for additional planning time (Flack et al., 2020), alongside additional technological training to reduce anxiety (mentioned above) (Molise & Dube, 2020), increased financial support to purchase remote lab kits for senior high school students (Kelley, 2020), alongside counselling and pastoral support for teachers (Wong & Moorhouse, 2020).

Recommendations for teachers

The most frequently suggested recommendation for teachers (see Table 8 and Appendix V) was to include opportunities for interaction (12%), both synchronously and asynchronously, which is a key feature in promoting student engagement when using technology (Bond, 2020b). Studies discussed the impact on students of the lack of physical interaction with their peers and their teachers, leading to feelings of being excluded and invisible (Bergdahl & Nouri, 2020). Suggestions included daily video conferencing sessions with teachers "as a point of pastoral care just to read a story and say morning" (Toseeb et al., 2020, p. 10), increased opportunities to have video calls with classmates (Riwai-Couch et al., 2020), virtual gyms (Niemi & Kousa, 2020), and partnering students for virtual experiments (Kelley, 2020). Asynchronous suggestions included using an official platform for sharing experiences and interaction amongst students and the teacher (Foti, 2020), such as Class Dojo or Google Classroom, where live notifications can be enabled and collaborative activities such as group annotation and brainstorming can be fostered (Jayathirtha et al., 2020).

Table 8. Top five recommendations for teachers

Recommendation	Frequency	Percentage
Design activities with interaction	11	12%
Use appropriate technology	8	9%
Scaffold work and provide differentiation	7	8%
Use asynchronous methods	6	7%
Undertake professional development	5	6%

Choosing appropriate technology was the next most recommended (9%), as some parents and students struggled with the amount of different platforms and links used (e.g., Riwai-Couch et al., 2020). Using technology that students (and parents) are already familiar with, such as social media channels, can reduce anxiety and technology overload (Fiialka, 2020; Lapada et al., 2020), as can using one main LMS, which parents in Zhang's (2020) study suggested could also then support after-school tutoring. Also important is the need to explain why technology is being used (Arlinwibowo et al., 2020), and to provide learning materials in multiple ways, to increase accessibility. For example, including text for any audio or video recordings, captioning videos, and providing video introductions for asynchronous work (Lambert & Schuck, 2020). Babinčáková and Bernard (2020) suggest combining screenshots with written notes for students who have trouble taking notes during synchronous sessions, as well as using applications such as Whiteboard.fi, which allows teachers to take notes on the screen.

A lack of scaffolding and differentiation of activities emerged as a theme within studies, not just for students with special needs (Bergdahl & Nouri, 2020), but also to scaffold learning for parents (Novianti & Garzia, 2020; Roe et al., 2020), as well as to reflect what students are reasonably able to undertake, given a "learner's level of limited capacity restricted by social distancing" (Lapada et al., 2020, p. 141). Whilst it is recognised that providing differentiated activities during emergency remote teaching "requires time, effort and focus from a teacher" (Rasmitadila et al., 2020, p. 103) that may understandably far exceed their capacity, further attention is needed in this area to ensure that tasks are not being given

far above (or below) student abilities (Toseeb et al., 2020), especially if periods of lockdown are going to be extended into the foreseeable future.

Teachers are encouraged to undertake further professional development in the area of technological pedagogical knowledge, especially those who have been teaching longer and for whom perhaps technology has not been a regular part of their teaching practise (Lapada et al., 2020). Professional learning that is challenging (Lansangan, 2020), and that focuses on skill development with online tools, such as collaborative environments and video conferencing software, is particularly recommended (Santi et al., 2020).

Recommendations for future research

Suggestions for future research on teaching and learning during the pandemic were mostly centred on conducting the authors' research within different contexts. 16 studies, however, did make other explicit recommendations (see Table 9 and Appendix W). The most frequent recommendation (*n* = 6) was for further research into the support available, alongside effective interventions, to help vulnerable populations, such as students with disabilities (Kaden, 2020; Lucas et al., 2020), young children (Flack et al., 2020), homeless students (Kaden, 2020), migrants and refugees (Primdahl et al., 2020), and those from lower-socio economic backgrounds (Niemi & Kousa, 2020). This is also a priority topic for UNICEF, whose COVID-19 and children rapid research response agenda includes child protection, education, social protection, child well-being, and children online (UNICEF, 2020).

Table 9. Top five recommendations for future research

Recommendation	Frequency	Percentage
Equity and vulnerable populations	6	7%
Partner with families	3	3%
Give more students voice in research	3	3%
Partner with teachers and schools in research design	2	2%
Triangulate teacher and student experiences	2	2%

The next two most frequent suggestions (*n* = 3 each) were partnering with families and giving students more voice in research. Partnering with families related not just to increased research that include parents as research participants (Bubb & Jones, 2020; Lambert & Schuck, 2020), but also to explicitly seeking input from - and working together with - families on how to create effective (online) learning environments (Bhamani et al., 2020). The studies in this review also called for an increase in student voice (Bubb & Jones, 2020), particularly for students who are marginalised (Lambert & Schuck, 2020; Schaefer et al., 2020). Studies also suggested increased triangulation of student and teacher experiences (Kim & Asbury, 2020; Primdahl et al., 2020), partnering with teachers and schools in research design (Kaden, 2020; Lambert & Schuck, 2020), and capturing a variety of data across longitudinal studies (van der Spoel et al., 2020; Wong & Moorhouse, 2020), particularly from larger sample sizes (Talidong, 2020). Suggestions for other methods of data collection during lockdown times include process-based portfolios, journals, and "frequent but short quizzes on student understanding" (Jayathirtha et al., 2020, p. 388).

Conclusion and Suggestions

This review synthesised research from 89 studies conducted during the first 7 months of the COVID-19 pandemic. Research centred predominantly on general challenges around the switch to ERE, as well as teacher digital competencies and digital infrastructure, with teacher ICT skills, family access to technology, parent engagement in learning, and student health and well-being key foci. Qualitative studies were conducted marginally more, with online surveys by far the most used research method, given national lockdown and social distancing conditions. Whilst this review only provides a snapshot of the teaching and learning that occurred, this synthesis can help inform policy, practice and future research.

Implications for policy and practice

Teachers must have the skillset for online and remote teaching, and not just within emergency contexts (Barbour et al., 2020), which starts with clear policy and directed guidance for schools. Two thirds of teachers surveyed by the Chartered College of Teaching in the UK, for example, found guidance for remote learning by the Department for Education unhelpful, and 80% were further dissatisfied with how the DfE then listened to feedback about it (Gibbons, 2020). Using frameworks such as that provided by Philipsen et al. (2019) to guide teacher online and blended learning professional development, with particular recognition of teachers' context (An, 2020), would be an excellent start. Aside from ensuring that practicing teachers are given ample professional development opportunities, support and equipment, initial teacher education programs also need to include targeted preparation for teaching with a range of software, across distance, online, blended and face-to-face contexts (Abaci et al., 2020).

Open and frequent communication is needed between schools and families (Daniel, 2020), which may involve consulting families as to their preferred methods. To this end, using platforms with collaborative features and push notifications can assist information dissemination, as well as promote interactivity between students, alongside providing parents with greater insight into learning activities. Parents and students need further guidance in how to use new technologies, as well as how to use them effectively for learning. Online information sessions organised between teachers, or even between schools, could help reduce the burden on individual teachers to provide information and advice to families. Developing and nurturing online professional networks can also be a rich source of motivation and support for teachers (Abaci et al., 2020; An, 2020), and they are therefore encouraged to join networks on, for example, Facebook and/or Twitter. Hashtags on Twitter that have been found helpful include #edutwitter, #teachertwitter, #NQT, #PGCEchat, and #edchat.

Implications for future research

Whilst much of the research that was conducted in the early stages of the pandemic was somewhat rushed, due to the urgent need to understand what was happening, one third of studies omitted important information about study design. It is vital that authors provide as much information as possible, especially around when and where data was collected, given the fluctuations in the spread of the virus, as well as the specific technology used and the types of schools and/or year levels involved. This enables readers to better understand the research context, and to decide whether or not the results and recommendations can be applied in their own situation (Slavin, 2008).

Given the gaps identified in this review, future research is encouraged into triangulating the experiences of students, particularly primary school aged and disadvantaged populations (including SEND students), with those of parents and teachers. This review found little research from Africa, Oceania, the Middle East or South and Central America, as well as a paucity of information around student digital competencies and assessment. Future research planned by the author of this review includes synthesising a larger number of studies against the three domains of student engagement factors (see Bond, 2020b), to provide greater insight into which technologies are more associated with instances of engagement and disengagement during ERE.

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Appendices

Appendix A – Tabulated list of included articles (*n* = 90)

Author	Open Access?	Continent	Country	Participants	# Participants	Institution type	Approach	Data collection
Aguliera	First 6 months	North America	US	T	2	PS	Phenomenology	Unclear
Ahlström, Leo, Norqvist & Isling	Yes	Europe	Sweden	L	316	PS, HS	Qualitative	Unclear
Anderson & Hira	First 6 months	North America	US	T	6	PS	Qualitative	April
Andrew et al.	Yes	Europe	United Kingdom	P	4,157	PS, HS	Quantitative - NE	April, May
Arlinwibowo et al.	Yes	Asia	Indonesia	T	49	HS	Phenomenology	April
Asbury et al.	Yes	Europe	United Kingdom	P	241	PS, HS, SEND	Qualitative	March, April
Atmojo & Nugroho	Yes	Asia	Indonesia	T	16	HS	Qualitative	Unclear
Babincakova & Bernard	Yes	Europe	Slovakia	T, S	95	HS	Quantitative - NE	May
Bagoly-Simo et al.	Yes	Europe	Germany	T	15	HS	Qualitative	March
Baloran & Hernan	Yes	Asia	Philippines	T	1,340	PS, HS	Quantitative – NE	May, June
Berasategi et al.	Yes	Europe	Spain	P	1,046	PS, HS	Quantitative – NE	March, April
Bergdahl & Nouri	Yes	Europe	Sweden	T	153	K, PS, HS	Qualitative	March
Bhamani et al.	Yes	Asia	Pakistan	P	19	Unclear	Qualitative	Unclear
Bhaumik & Priyadarshini	Yes	Asia	India	S	74	HS	Quantitative – NE	Unclear
Bobo et al.	Yes	Europe	France	P	533	Unclear	Qualitative	April
Bonal, & González	Yes	Europe	Spain	P	35,419	PS, HS, HE	Quantitative – NE	March
Brelsford et al.	No	North America	US	T	33	PS, HS	Qualitative	March, April. May
Brom et al.	Yes	Europe	Czech Republic	P	8,166	PS, HS	Quantitative – NE	April
Bubb & Jones	Yes	Europe	Norway	T, S, P, L	1,995	PS, HS	Case study	April, May
Burns	First 6 months	North America	US	T	45	PS, HS	Participatory design	Unclear
Cahapay	Yes	Asia	Philippines	P	5	HS, HE	Qualitative	Unclear
Clausen, Bunte & Robertson	Yes	North America	US	T	44	HS	Quantitative – NE	Unclear
Crick et al.	No	Europe	United Kingdom	T	2,197	PS, HS, HE	Mixed methods	March, April
Daley et al.	No	North America	US	T	4	PS, MS, HS	Case study	Unclear
Dempsey & Burke	Yes	Europe	Ireland	L	939	PS	Quantitative – NE	May
Dvir & Schatz-Oppenheimer	Yes	Middle East	Israel	T	32	Unclear	Quali – Narrative	Unclear
Eivers, Worth & Ghosh	Yes	Europe	United Kingdom	P	2,462	PS, HS	Quantitative – NE	April
Fiialka	Yes	Europe	Ukraine	T	830	HS	Quantitative – NE	April, May
Flack et al.	Yes	Oceania	NZ, Australia	T, L	3,556	PS, HS	Quantitative – NE	April
Foti	Yes	Europe	Greece	T	101	K	Quantitative – NE	April, May
Giovannella et al.	Yes	Europe	Italy	T	336	PS, MS, HS	Quantitative – NE	May
Gudmundsdottir & Hathaway	Yes	Europe, North A.	USA, Norway	T	813	Unclear	Quantitative – NE	March, April
Hamilton et al.	Yes	North America	US	T, L	1,957	K, PS, MS, HS	Quantitative – NE	April, May
Huber & Helm	Yes	Europe	Germany, Austria, Switzerland	T, S, P, L, A	7,116	K, PS, HS	Quantitative – NE	March, April
Hunter et al.	Yes	Oceania	NZ	T, L	24	PS	Qualitative	Unclear
Jayathirtha et al.	First 6 months	North America	US	T, S	39	HS	Qualitative	March, April
Kaden	Yes	North America	US	T	1	HS	Case study	March, April, May
Kelley	Yes	North America	US	S	59	HS	Quantitative – NE	March – June
Kim & Padilla	Yes	North America	US	S, P	20	Unclear	Case study	August

Note: North A. = North America, US = United States, NZ = New Zealand, T = Teachers, L = Leaders, S = Students, P = Parents, K = Kindergarten, A = Administrators, PS = Primary school, MS = Middle School, HS = High School, HE + Higher Education, SEND = Special educational needs and disabilities school, NE = non-experimental

Author	Open Access?	Continent	Country	Participants	# Participants	Institution type	Approach	Data collection
König, Jäger-Biela & Glutsch	Yes	Europe	Germany	T	89	PS, HS, SEND	Case study	May, June
Kraft, Simon & Arnold Lyon	Yes	North America	US	T	5,957	PS, MS, HS	ITS	April, May, June
Lambert & Schuck	Yes	North America	US	T	1	PS	Case study	March
Lansangan	Yes	Asia	Philippines	T	1	HS	Autoethnography	Unclear
Lapada, Miguel, Robledo & Alam	Yes	Asia	Philippines	T	2,300	PS, HS, HE	Qualitative	Unclear
Larcher et al.	Yes	Europe	United Kingdom	S	15	HS, HE	Qualitative	May
Letzel, Pozas & Schneider	Yes	Europe	Germany	T, S, P	521	Unclear	Mixed methods	April, May, June
Lucas, Nelson & Sims	Yes	Europe	United Kingdom	T, L	3,054	PS, HS	Quantitative – NE	May
Mailizar et al.	Yes	Asia	Indonesia	T	159	HS	Quantitative – NE	Unclear
Majoko & Dudu	Yes	Africa	Zimbabwe	P	8	PS, HS	Qualitative	Unclear
Molise & Dube	Yes	Africa	South Africa	T	10	Unclear	Qualitative	Unclear
Moss et al.	Yes	Europe	United Kingdom	T, L	1,653	PS	Quantitative – NE	May
Ng et al.	Yes	Asia	Indonesia	T, S, L	3 schools	PS, HS	Case study	Unclear
Niemi & Kousa	Yes	Europe	Finland	T, S, L	309	HS	Case study	March, April, May
NortonLifeLock	Yes	North America	US	P	1,002	PS, HS	Quantitative – NE	August
Novianti & Garzia	Yes	Asia	Indonesia	P	148	PS	Mixed methods	March, April
Ocana et al.	Yes	South America	Ecuador	S	137	PS	Quantitative (PPT)	Jan – June
Okebukola et al.	Yes	Africa	Ghana, Nigeria, Senegal, Burundi, Morocco	T	5	HS	Qualitative	Unclear
Parczewska	Yes	Europe	Poland	P	278	K, PS, HS	Quantitative – NE	Unclear
Peterson et al.	First 6 months	North America	US	T, L, A	4	K, PS, HS	Case study	Unclear
Pietro & Madonna	Yes	Europe	Italy	S	20	HS	Qualitative	April, May
Popyk	Yes	Europe	Poland	S	19	PS	Qualitative	June, July
Primdahl et al.	Yes	Europe	Denmark	T	8	HS	Qualitative	March
Putri et al.	Yes	Asia	Indonesia	T, P	15	PS	Case study	Unclear
Race	Yes	Asia	Philippines	T	115	PS, HS	Mixed methods	Unclear
Rap et al.	Yes	Middle East	Israel	T	193	HS	Quantitative – NE	Unclear
Rasmitadila et al.	Yes	Asia	Indonesia	T	67	PS	Case study	May
Reimers & Schleicher	Yes	Europe, North A., Asia, Africa, South A., Middle East	Many	T, L, A, G	1,370	PS, HS	Quantitative – NE	April, May
Riwai-Couch et al.	Yes	Oceania	NZ	P	134	PS, HS	Qualitative	Unclear
Roca et al.	Yes	Europe	Spain	T, L	10	PS, HS, SEND	Participatory design	March, April
Roe et al.	Yes	Europe	Norway	P	4,642	PS, HS	Quantitative – NE	April
Sandvik	No	Oceania	Australia	T, S	300	PS, MS, HS	Qualitative	Unclear
Santi et al.	Yes	Europe	Romania	T	125	HS	Quantitative – NE	Unclear
Schaefer et al.	Yes	North America	US	S, P	5	HS	Autoethnography	April
Sintema	Yes	Africa	Zambia	T	3	HS	Case study	Unclear
Sulisworo et al.	Yes	Asia	Indonesia	S	81	HS	Quantitative – NE	March
Talidong	Yes	Asia	China	T	20	PS	Quantitative – NE	April, May
Torrau	Yes	Europe	Germany	T, S	25	HS	Case study	March, April
Toseeb et al.	Yes	Europe	United Kingdom	P	339	PS, HS, SEND	Quantitative – NE	March, April, May

Note: North A. = North America, South A. = South America, US = United States, NZ = New Zealand, T = Teachers, L = Leaders, S = Students, P = Parents, K = Kindergarten, A = Administrators, G = Government officials, PS = Primary school, MS = Middle School, HS = High School, HE + Higher Education, SEND = Special educational needs and disabilities school, NE = non-experimental, PPT = pre post test design, ITS = interrupted time series

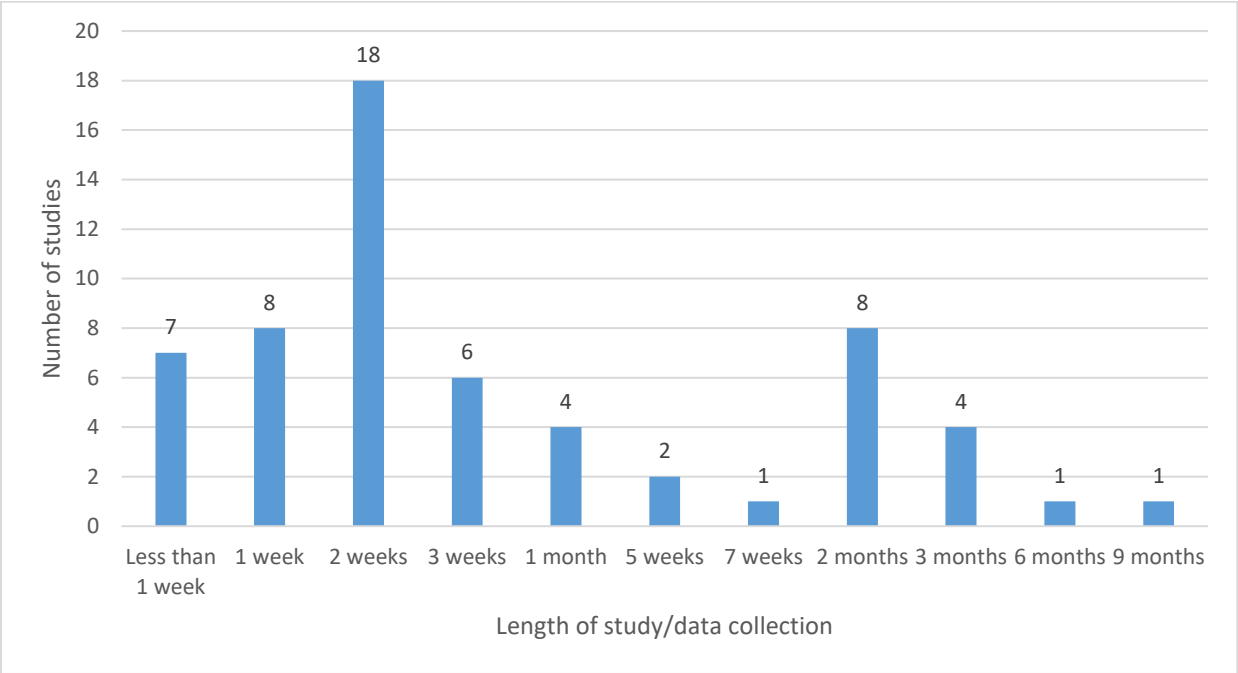
Author	Open Access?	Continent	Country	Participants	# Participants	Institution type	Approach	Data collection
Tran et al.	Yes	Asia	Vietnam	S	420	HS	Quantitative – NE	February
Trung et al.	Yes	Asia	Vietnam	S	420	HS	Quantitative – NE	February
Trust & Whalen	Yes	North A., Asia, Europe, Africa	US, China, Italy, Spain, Canada, Egypt	T	325	K, PS, MS, HS	Quantitative – NE	April, May
Turner, Hughes & Presland	No	Europe	United Kingdom	T	110	HS	Quantitative – NE	Unclear
Van der Spoel et al.	Yes	Europe	Netherlands	T	200	PS, HS, HE	Quantitative – NE	March, April, May
Vu et al.	Yes	Asia	Vietnam	T	294	K, PS, HS, HE	Quantitative – NE	April
Whittle et al.	First 6 months	North America	US	T, LD	9	Unclear	Participatory design	Unclear
Wong & Moorhouse	Yes	Asia	Hong Kong	T	10	PS, HS	Qualitative	March, April
Yang	Yes	Asia	China	T	15,438	K, PS, HS	Quantitative – NE	February
Zhang	Yes	Asia	China	T, P	886	PS, HS	Case study	April, May
Zhao et al.	Yes	Asia	China	T, S, P	2,010	PS, HS	Quantitative – NE	March

Note: North A. = North America, South A. = South America, US = United States, NZ = New Zealand, T = Teachers, L = Leaders, S = Students, P = Parents, K = Kindergarten, A = Administrators, G = Government officials, PS = Primary school, MS = Middle School, HS = High School, HE + Higher Education, SEND = Special educational needs and disabilities school, NE = non-experimental, PPT = pre post test design, ITS = interrupted time series

Appendix B – List of publications

Journal Name	*f*	Journal Name	*f*
Information and Learning Sciences	6	KIMIKA	1
Journal of Chemical Education	5	L'Encéphale	1
European Journal of Teacher Education	3	Media Education (Mediaobrazovanie)	1
Journal of Technology and Teacher Education	3	Medical Science Monitor	1
Asian Journal of Distance Education	2	Middle Grades Review	1
Data in Brief	2	Open Education Studies	1
EURASIA Journal of Mathematics, Science and Technology Education	2	Register Journal	1
International Journal of Developmental Disabilities	2	Revista Românească pentru Educaţie Multidimensională	1
International Journal of Learning, Teaching and Educational Research	2	Technology, Knowledge and Learning	1
International Studies in Educational Administration	2	Tijdschrift voor Economische en Sociale Geografie	1
Sustainability	2	Universal Journal of Educational Research	1
Agora	1	Vulnerable Children and Youth Studies	1
Archives of Disease in Childhood	1		
British Journal of Educational Psychology	1		
ECNU Review of Education	1		
Education 3-13	1		
Education Sciences	1		
Educational Assessment, Evaluation and Accountability	1		
European Journal of Open Education and E-learning Studies	1		
European Societies	1		
Frontiers in Education	1		
Frontiers in Psychology	1		
Hispanic Journal of Behavioral Sciences	1		
IEEE Access	1		
Improving schools	1		
International Journal of Advanced Science and Technology	1		
International Journal of Evaluation and Research in Education	1		
International Journal of Technology in Education and Science	1		
International Review of Education	1		
Journal of Autism and Developmental Disorders	1		
Journal of Education and Educational Development	1		
Journal of Ethnic and Cultural Studies	1		
Journal of Information Technology Education: Research	1		
Journal of Loss and Trauma	1		
Journal of Physical Education and Sport	1		
Journal of Social Science Education	1		
Journal of Teaching and Learning in Elementary Education	1		
Journal of Theoretical and Applied Information Technology	1		

Appendix C – Length of studies/data collection



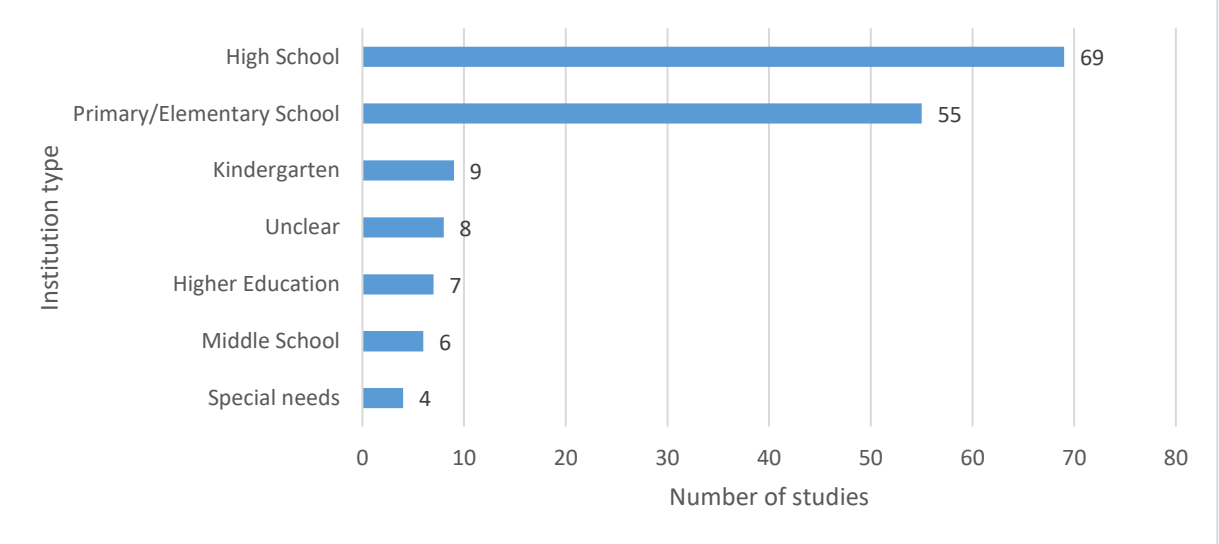
Appendix D – Length of studies/data collection cross-tabulated with the type of data collection tool

	Not mentioned	Less than 1 week	1 week	2 weeks	3 weeks	1 month	5 weeks	7 weeks	2 months	3 months	6 months	9 months
Interviews	16	0	1	3	1	1	0	1	3	1	0	0
Online survey	14	7	8	15	3	3	2	1	7	2	0	1
Focus groups	4	1	0	1	1	1	0	0	0	1	1	0
Content analysis (media)	1	0	0	0	1	0	0	0	0	0	0	0
Written reflections	6	0	0	1	0	1	0	0	0	1	0	0
Participant observation	1	0	0	0	2	0	0	0	0	2	0	1
Artifacts	3	0	0	0	2	0	0	0	1	1	0	1
Test (assessment)	0	0	0	0	0	0	0	0	0	1	0	1
Log data	0	0	0	0	0	0	0	0	0	0	0	1
Time diary	0	0	0	1	0	0	0	0	0	0	0	0
Field notes	0	0	0	0	2	0	0	0	0	0	0	0

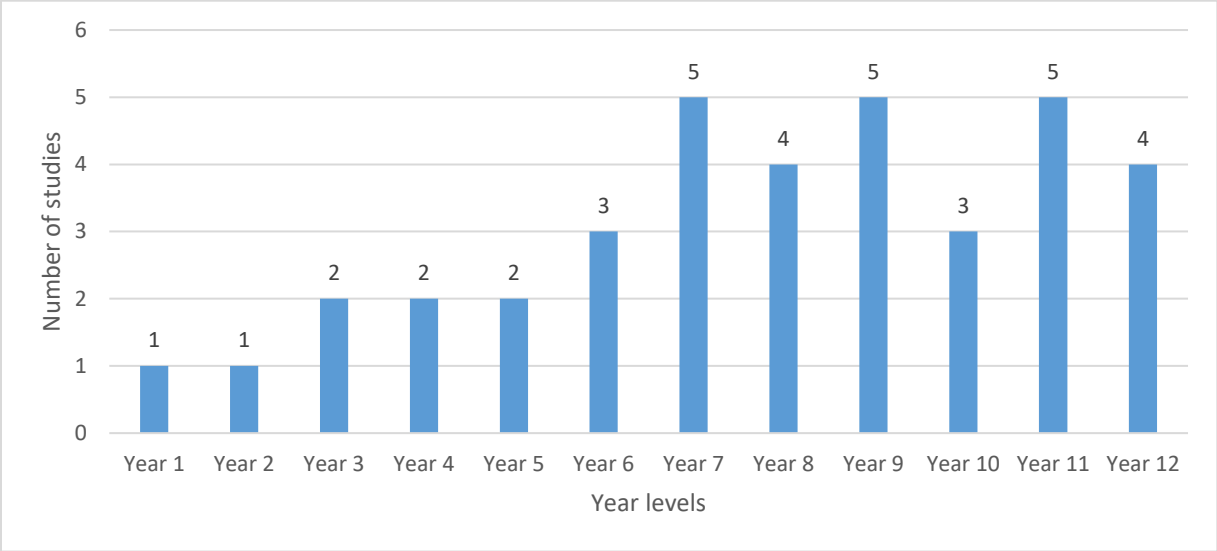
Appendix E – Country of study participants

Country	*f*	Country	*f*
USA	20	Estonia	1
UK	11	Georgia	1
Indonesia	9	Ghana	1
Germany	6	Hong Kong	1
China	5	Hungary	1
Philippines	5	Iceland	1
Spain	5	India	1
Italy	4	Ireland	1
Norway	4	Jamaica	1
New Zealand	3	Japan	1
Sweden	3	Jordan	1
Vietnam	2	Kazakhstan	1
Australia	2	Latvia	1
Austria	2	Lithuania	1
Canada	2	Madagascar	1
Czech Republic	2	Mexico	1
Ecuador	2	Morocco	1
Finland	2	Peru	1
France	2	Portugal	1
Greece	2	Republic of Korea	1
Israel	2	Romania	1
Nigeria	2	Russia	1
Pakistan	2	Senegal	1
Poland	2	Slovakia	1
South Africa	2	Slovenia	1
The Netherlands	2	Switzerland	1
Argentina	1	Timor-Leste	1
Belgium	1	Tunisia	1
Brazil	1	Ukraine	1
Burundi	1	Uruguay	1
Central African Republic	1	Zambia	1
Chile	1	Zimbabwe	1
Colombia	1		
Costa Rica	1		
Croatia	1		
Denmark	1		
Dominican Republic	1		
Egypt	1		

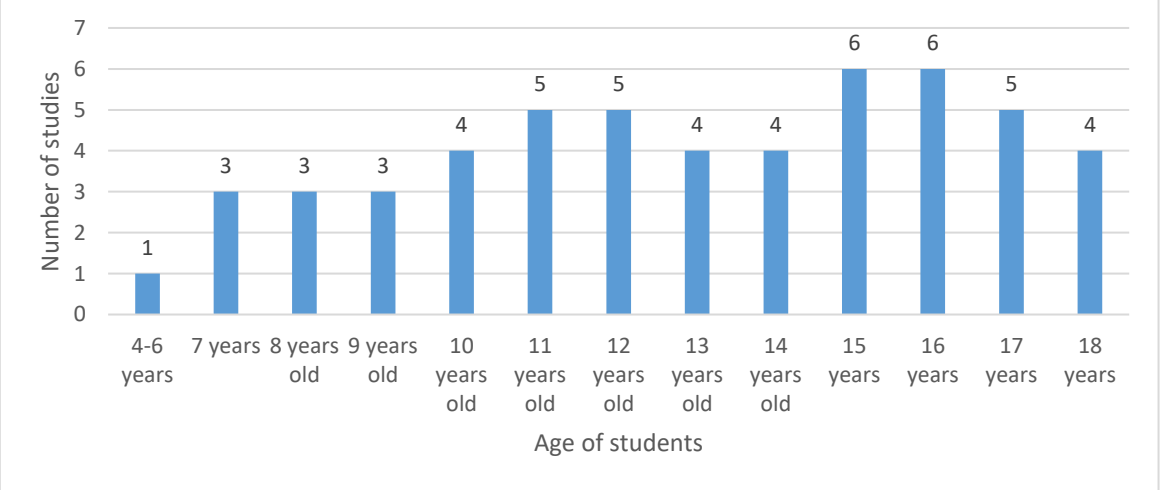
Appendix F – Institution type



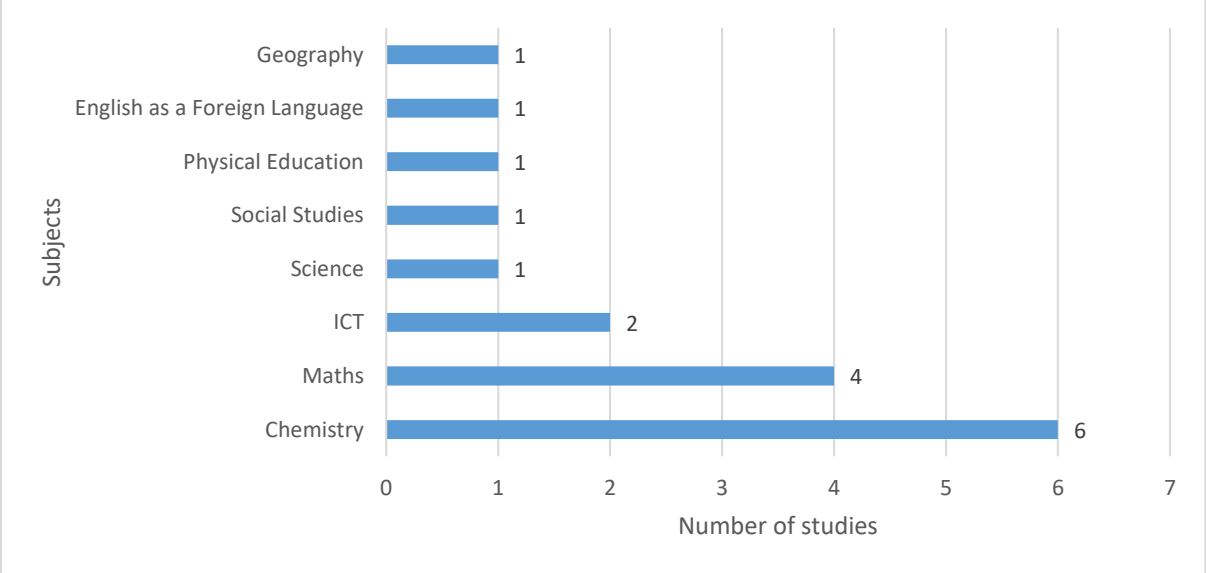
Appendix G – Year level of participants (in studies including students)



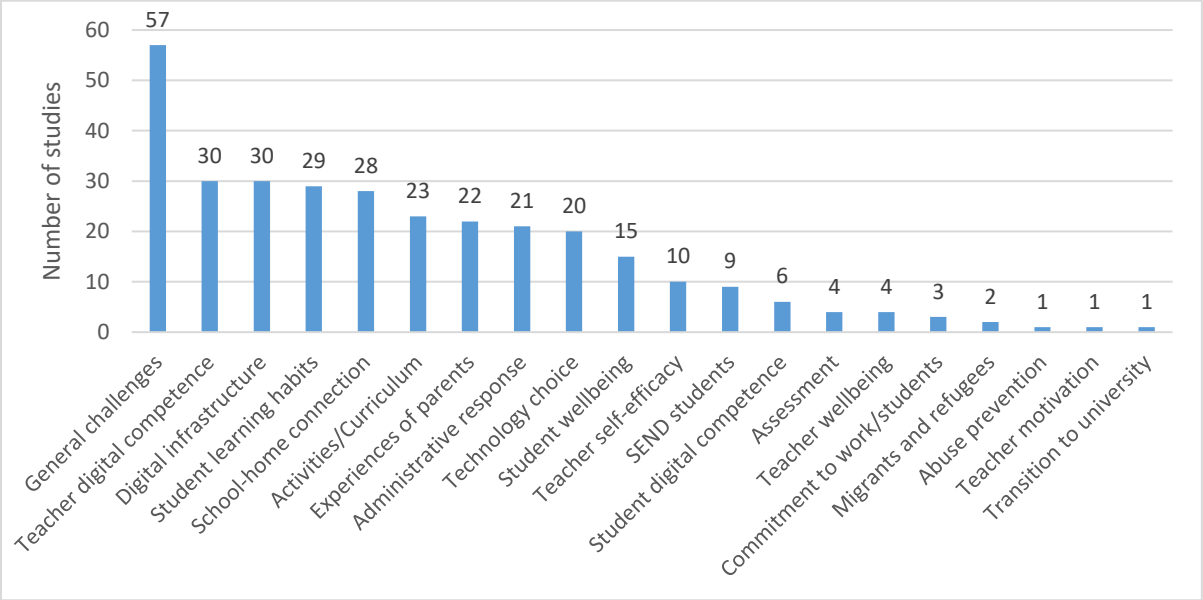
Appendix H – Ages of participants (in studies including students)



Appendix I – Subject areas of studies (where explicitly mentioned)



Appendix J – Topic focus of articles



Appendix K – Topic focus of studies by continent

	Africa	Asia	Europe	Oceania	Middle East	North America	South America
Teacher digital competence	3	11	12	2	4	6	1
School-home connection	0	3	15	3	0	7	0
Digital infrastructure	2	5	10	3	1	9	0
Administrative response	2	5	10	1	1	6	1
Technology choice	1	5	9	1	1	6	2
General challenges	3	14	26	3	4	15	1
Teacher self-efficacy	0	3	4	0	2	1	0
Commitment to work/students	0	1	0	0	0	2	0
Experiences of parents	1	6	12	1	0	2	0
Student digital competence	0	2	1	1	0	1	1
SEND students	1	1	5	0	0	2	0
Activities/Curriculum	2	4	11	1	1	7	2
Abuse prevention	0	0	1	0	0	0	0
Assessment	1	0	1	0	0	2	0
Student learning habits	1	8	14	2	1	6	2
Student wellbeing	1	2	11	1	1	3	1
Teacher motivation	0	1	0	0	0	0	0
Transition to university	0	0	1	0	0	0	0
Teacher wellbeing	0	0	2	1	0	1	0
Migrants and refugees	0	0	2	0	0	0	0

Appendix L – Technology used

Technology	*n*	Technology	*n*	Technology	*n*
Zoom	26	Discussion forums	2	URPlay	1
Google Classroom	19	Google Drive	2	Sli	1
Other unnamed LMS	17	Class Dojo	2	SLearning platform	1
Videos (teacher made)	14	Showbie	2	Screencastify	1
Video conferencing (unknown)	12	BBC Bitesize	2	Flipgrid	1
Email	11	Oak Academzy	2	Blackboard	1
Facebook	9	DingTalk	2	Explain Everything	1
WhatsApp	9	WeChat	2	Codecombat	1
Chat/messaging (unknown)	9	Moodle	1	Blogs	1
YouTube	7	Edpuzzle	1	International Children's digital library	1
PowerPoint	6	Podcasts	1		
Google Meet	6	Twitter / Snapchat	1	Radio	1
Videos (made by others)	5	Learning games	1	PowToon	1
Google Forms	5	Autodesk SketchBook	1	Alcody	1
Google Docs	5	FastStone Capture	1	Formative	1
Schoology	5	TEDEd	1	WebASsign	1
Seesaw	4	Sumdog	1	Google Slide Deck	1
Teams	4	Paragraph Punch	1	Twinkl	1
TV lessons	4	Spelling City	1	Padlet	1
Videos (uncertain origin)	3	The OT Toolbox	1	Jitsi	1
Self-assessment quizzes	3	Google Hangout	1	MeisterTask	1
Webex	3	Gleerups	1	MOOCs	1
Kahoot	3	Bingel	1	Chaoxing	1
Tencent Meeting	3	GSuite	1	CCTalk	1
Edmodo	2	Compass	1	Daymap	1
Microsoft 365	2	Education Perfect	1	Skype	1

Appendix M – Teacher influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	ICT skills & knowledge	33	37%
2	Support	29	32%
3	Feedback	28	31%
4	Presence	23	26%
5	Professional development	22	24%
=	Teacher well-being	22	24%
6	Use of technology	20	22%
7	Prior ICT experience	19	21%
8	Professional networks	18	20%
=	Self-efficacy	18	20%
9	Technology acceptance	16	18%
=	Time invested	16	18%
10	Access to technology	15	17%
11	Content expertise	3	3%
12	Motivation	3	3%

Appendix N – Familial influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	Access to technology	49	54%
2	Parental involvement & engagement with learning	48	53%
3	Socio-economic background*	34	38%
4	Communication	21	23%
5	Health & well-being	12	13%
6	ICT skills & knowledge	8	9%
7	Engagement with content	5	6%
8	Self-efficacy (as an educator)	4	4%
9	Technology acceptance	3	3%
=	Attitude towards learning	3	3%
10	Relationships	2	2%
=	Professional/personal development	2	2%
11	Level of parent education	1	1%

NB – * Socio-economic background (also related to Family) was coded, however this is technically part of the exo-system in the Bioecological model.

Appendix O – Student influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	Health & well-being	39	43%
2	Amount of time studying	32	36%
3	Motivation	31	34%
4	Self-regulation	20	22%
5	Learning gains	16	18%
6	ICT skills & knowledge	15	17%
7	Approach familiarity	9	10%
8	Technology acceptance	7	8%
9	Interest	6	7%
10	Self-efficacy	4	4%
11	Prior ICT experience	2	2%

Appendix P – Institutional influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	Infrastructure	25	28%
2	Support of staff	21	23%
3	Technology/distance education policy	20	22%
4	Communication	15	17%
5	Curriculum policy	12	13%
=	Support for parents and students	12	13%
6	Professional development policy	11	12%
7	Needs analysis	3	3%
8	Partnerships	2	2%

Appendix Q – Curricula influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	Design	31	34%
2	Use of technology	9	10%
3	Reinforcement	4	4%
4	Level of challenge	2	2%
=	Useful/authentic	2	2%
=	Relevant	2	2%
=	Collaborative/hands on	2	2%
5	Quality	1	1%

Appendix R – Learning environment influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	Assessment	22	24%
2	Usability	8	9%
=	Accessibility	8	9%
3	Sense of community	7	8%
=	Collaborative	7	8%
4	Access to technology	5	6%
=	Design	5	6%
5	Technology choice	4	4%
=	Supportive	4	4%
=	Content length	4	4%

Appendix S – Peer influencing factors on teaching and learning

Rank	Influencing factor	Frequency	Percentage
1	Opportunities to collaborate	23	26%
2	Respectful relationships	4	4%
3	Respond to the work of others	2	2%
4	Clear boundaries and expectations	1	1%
=	'Seeing' each other	1	1%
=	Sharing	1	1%

Appendix T – Recommendations for Departments of Education

Rank	Influencing factor	Frequency	Percentage
1	Provide further funding for PD & equipment	9	10%
2	Provide further funding in areas of disadvantage	4	4%
3	Improve information dissemination	3	3%
=	Support OER development	3	3%
=	Take disadvantage into consideration	3	3%
4	Consider hybrid learning	2	2%
=	Greater support for Safeguarding leads	2	2%
5	PD on improving uncertainty management skills	1	1%
=	Allow mobile phones to be used	1	1%
=	Allow schools greater freedom to allocate money	1	1%
=	Involve school leaders	1	1%
=	Set up a remote advice service for parents of SEND children	1	1%
=	Respite care for SEND children	1	1%
=	Greater support for Year 11 students	1	1%
=	Lift restrictions around distance learning (privacy)	1	1%

Appendix U – Recommendations for schools

Rank	Influencing factor	Frequency	Percentage
1	Provide professional development	28	31%
2	Prioritise equity	13	14%
=	Provide internet access/Invest in infrastructure	13	14%
3	Develop blended learning competency	9	10%
4	Support staff	8	9%
5	Conduct a needs analysis	7	8%
=	Relationships	7	8%
6	Choose appropriate technology	6	7%
7	Let content take a back seat	5	6%
=	Encourage parents	5	6%
=	Provide mental health support	5	6%
8	Collaborate with partners	4	4%
=	Communication	4	4%
=	Focus on child health health and well-being	4	4%
9	Lead with empathy	3	3%
=	Limit the number of tech tools	3	3%
=	Use an LMS	3	3%
10	Adjust teacher workload	2	2%
11	Develop culture of trust	1	1%
=	Evaluate modes of communication	1	1%
=	Reduce emphasis on grades	1	1%
=	Establish open doors actions	1	1%
=	Adjust for longer term planning	1	1%
=	Extra support may be needed for teachers new to schools	1	1%
=	Strengthen students' self-regulated learning	1	1%
=	Librarians could assist with access	1	1%
=	Hold online story hours	1	1%
=	Provide childcare for teachers	1	1%
=	Use a combination of platforms	1	1%
=	Engage with research (school level)	1	1%
=	Seek student feedback	1	1%

Appendix V – Recommendations for teachers

Rank	Influencing factor	Frequency	Percentage
1	Design activities with interaction	11	12%
2	Use appropriate technology	8	9%
3	Scaffold work and provide differentiation	7	8%
4	Use asynchronous methods	6	7%
5	Undertake professional development	5	6%
6	Teach students time management skills	4	4%
=	Use consistent means of communication	4	4%
7	Provide feedback	3	3%
=	Communicate amongst teachers about deadlines	3	3%
=	Join professional networks	3	3%
=	Reduce workload on students	3	3%
8	Explain tech objectives	2	2%
=	Assess knowledge using online quizzes	2	2%
=	Work collaboratively	2	2%
=	Give authentic assessment	2	2%
=	Provide printed material	2	2%
=	Record online lessons and experiments	2	2%
9	Develop trust	1	1%
=	Teach tech skills first	1	1%
=	Accept change	1	1%
=	Encourage relaxation techniques	1	1%
=	Give disciplinary action when needed	1	1%
=	Manage due date expectations	1	1%
=	Standard rules across all classes	1	1%
=	Ensure students have time to ask questions	1	1%
=	Explain learning objectives	1	1%
=	Encourage self-assessment	1	1%
=	Offer specific contact/office hours	1	1%
=	Engage with research	1	1%
=	Make expectations clear	1	1%

Appendix W – Recommendations for future research

Rank	Influencing factor	Frequency	Percentage
1	Equity and vulnerable populations	6	7%
2	Partner with families	3	3%
=	Give more students voice in research	3	3%
3	Partner with teachers and schools in research design	2	2%
=	Triangulate teacher and student experiences	2	2%
=	Use other varied data collection methods	2	2%
=	Longitudinal design	2	2%
4	Include larger sample size	1	1%
=	Internationally comparative studies	1	1%
=	Further investigation of primary school students/families	1	1%
=	Investigate school leaders	1	1%