Education in times of crisis: Effective approaches to distance learning

A review of research evidence on supporting all students' learning, wellbeing and engagement

Lisa-Maria Müller and Gemma Goldenberg

CHARTERED COLLEGE OF TEACHING

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We would like to thank the reviewers who dedicated their time to provide feedback on this report

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Executive Summary

Lisa-Maria Müller *Education Research Manager, Chartered College of Teaching*

Gemma Goldenberg *Research and Learning Specialist, Chartered College of Teaching*

This report summarises some of the existing research literature on effective approaches to distance learning, and discusses emerging findings on the impact of the ongoing COVID-19 pandemic on children's learning and development. It shows that the number of students who have been engaged in distance learning throughout this pandemic is unprecedented, and that countries have adopted a range of approaches to support educational continuity throughout the crisis. High-income countries have mainly opted for online learning, which is also the main focus of this report, whilst radio broadcasts have been more commonly used in low-income countries. However, the lack of access to digital learning tools is also an issue in high-income countries such as England, where the attainment gap risks widening as a result, despite the significant efforts made by schools to reach these children via alternative means such as printed workpacks (see Müller and Goldenberg, 2020b). It is therefore of the utmost importance that schools are provided with adequate resources to support those students who may have had limited access to distance learning throughout this pandemic.

Online learning can present many benefits, including increased flexibility and potential for better accessibility and individualisation; but also numerous challenges, particularly in the current context, whereby distance learning has had to be put in place with little notice, and in many cases without the necessary technological infrastructure in place. The latter makes it difficult to extrapolate findings from planned distance learning contexts to current arrangements in schools, which is why it would be helpful for future research to examine what has worked best in current emergency remote teaching.

Despite these limitations, the report shows that effective pedagogical approaches are relatively independent of the medium in which they occur. Approaches that have been found to support student learning in the face-to-face classroom (e.g. high-quality feedback and formative assessment, supporting metacognitive strategies and collaborative learning) have also been found to be effective in an online learning environment. These strategies are also considered in the context of special educational needs and disabilities (SEND) and early years settings later in the report.

Feedback

The effectiveness of high-quality (formative) feedback in face-to-face teaching has been widely researched, and it is clear that it is equally important and effective in an online setting. The automated and dynamic feedback that is available in many online learning environments can provide a more personalised learning experience to students, thereby increasing their motivation and engagement. It is important, however, to find a balance between automated and peer or teacher feedback, as students can particularly benefit from the interactive component of the latter.

Feedback can also improve students' self-efficacy and confidence in an online environment, and can be particularly beneficial for students with certain SEND, such as attention deficit hyperactivity disorder (ADHD).

When using automated feedback, it is particularly important to consider that it is accurate and seems authentic to students, as otherwise it can lead to frustration and a negative learning experience. Feedback has been found to be particularly important for younger students who are more engaged in reading and learning when they receive immediate feedback and engage in shared reading or co-viewing. Finally, accessibility concerns need to be considered to ensure that students can access and process any feedback that is provided to them.

Metacognitive strategies and independent learning

One of the major challenges of distance learning is the higher levels of independent learning required from students in such settings. The need for increased levels of parental supervision is emphasised in particular for younger students and those with certain SEND such as Down's syndrome.

Teachers, researchers and academics (Müller and Goldenberg, 2020b; Dhawan, 2020) have acknowledged that students will be better equipped to deal with remote learning in the future if they have been supported in developing skills and attributes such as independent learning, self-regulation, time management and metacognition. The importance of developing metacognition and self-regulation from an early age and its links to academic achievement have been described extensively in the research literature (Whitebread et al., 2005; Whitebread et al., 2015; de Boer et al., 2018), and some teachers have reflected on whether there should be an increased focus on these skills in the future (Müller and Goldenberg, 2020b).

The development of metacognitive and independent learning skills is a long-term process and therefore cannot constitute a 'quick fix' for current issues in distance learning. However, the inclusion of reflection questions and scaffolds that make the learning process explicit to students, as well as supporting them in developing study and time management skills, may help students to overcome some of the challenges related to independent learning that they are experiencing at the moment.

Collaborative learning

It has been shown that collaborative learning can have a positive impact on students' academic development as well as their motivation and engagement in online classrooms. In online classrooms peer collaboration brings the additional benefit of creating a feeling of social presence, which can help students to feel part of a learning community and improve their motivation. It has also been shown that peer exchanges have helped to motivate younger students during distance learning throughout the pandemic.

It is important to note, however, that some approaches to collaborative learning may require certain adjustments so that students with SEND can benefit from them as much as their peers. For example, live discussions, whether in spoken or written form, can be challenging for students with some SEND due to the speed at which they occur, which can represent a challenge for students who have reading or writing difficulties and those who use screen readers. Audio-only content and discussions also represent a significant challenge for students who rely on, or benefit from, additional visual cues to understand their conversation partners.

Different approaches to distance learning will suit different students, and different lesson content. It is therefore paramount for distance learning to focus on pedagogy first and technology second. Learning objectives need to be the starting point of planning any distance learning, not least in the context of making learning accessible to all learners. When adapting online learning for students with SEND it is important to consider whether presenting the same content in a different way or using an educationally equivalent yet different activity will best support students to reach the learning objective rather than focusing purely on enabling assistive technology. Despite similar diagnoses, students with SEND are likely to have individual needs and preferences, which should be considered when planning distance learning.

Blended learning

This report also presents evidence on effective approaches and issues to consider in a blended learning environment, as many schools are likely to encounter such contexts as they reopen to more students. Blended synchronous learning can benefit students who may not be able to attend their face-to-face classrooms and has been associated with positive academic outcomes, but the vast majority of research in this area stems from university settings where sophisticated technology and, in some cases, dedicated technical support is available, which is likely not the case for most schools. The synchronous blended learning settings described in this report used multiple cameras, microphones, screens and a dedicated learning platform that allowed students to interact with each other and the teacher. Despite this support, blended learning settings can face a number of challenges, including cognitive overload for teachers and students due to the range of communication channels, and disengaged remote or frustrated face-to-face students if the technology is not working or instructions are unclear or irrelevant to either student group.

Schools who have access to the necessary technology and additional technological support and wish to implement synchronous blended learning in their settings should consider the planning principles outlined at the end of section two of this report. These include considerations for pedagogy such as grouping remote and face-to-face students, technology, such as choosing the appropriate technology for the learning objective and logistics, such as asking students to log in 10 minutes prior to a lesson.

Non-synchronous blended learning in which students complete part of their work online and part of their work in lessons may be a more viable long-term solution for schools that want to build on the skills that students and teachers have developed during this crisis and want to incorporate distance learning more permanently.

Motivation and engagement

Engagement and motivation are crucial for learning yet they represent a substantial challenge in distance learning and have been highlighted as a major challenge in the current context. Student motivation is closely linked to their self-efficacy and their perception of competence which is why it is important to pitch learning activities at the right level, so they are challenging yet encouraging to students. The online learning environment does provide some inherent advantages in this regard when apps are used that pitch learning content based on students' prior responses. An important aspect to consider in an online environment is that students may feel competent in their subject knowledge but lack knowledge and skills in using technology for their learning. Supporting students in learning how to use technology prior to the start of a new lesson can be helpful in avoiding frustration and keeping students engaged and motivated.

Helping students to develop a goal-oriented mindset and to understand that mistakes are part of the learning process can also support learning, both in face-to-face and distance learning settings.

The lack of social interaction can be problematic in online environments and is mentioned in studies with students of all ages, with or without SEND, in the current context and during planned distance learning. Opportunities for students to interact in a meaningful way can address this issue and help keep them motivated. The need for social interaction may also be part of the reason why data from current distance learning suggests that while older students in particular may welcome the additional freedom and flexibility, which they would like to maintain when schools reopen to more students, they still want to return to school for the majority of the week.

Assessing and developing students' technological self-efficacy and creating opportunities for students to connect, which can also happen through collaborative learning, seem like two important strategies to support student engagement and motivation in this time. Going forward, it could be considered whether some of the freedom and flexibility that older students have come to appreciate as a result of current arrangements could be maintained. Blended learning approaches would lend themselves to such arrangements but potential drawbacks would need to be considered carefully.

Mental health and wellbeing

The potential negative impact of the current crisis on some students, particularly those at crucial points in their development (i.e. younger children and adolescents) as well as students with autism spectrum disorder (ASD) who rely strongly on routines has been documented in a previous report (Müller and Goldenberg 2020a) and is further highlighted in this work. Reduced physical exercise and contact with nature, increased sedentary and non-educational screen time, disrupted routines, limited social contacts and stress can all negatively impact children's socio-emotional development, leading to changes in behaviour and emotions, such as emotional outbursts, depression or new behaviours or tics.

Schools may therefore want to consider raising students' awareness about these risk factors and propose ways to mitigate them, throughout and outside the school day. Beyond awareness raising, some schools may also want to consider scheduling the remote school day so that students have the chance to spend some time in their local park or woodland, incorporating physical exercise into the school day, limiting screen-based activities and incorporating activities that can be done individually and then shared (e.g. arts or crafts) – although the increased level of parental supervision needed for younger students during such activities needs to be considered. Raising awareness among parents about the potential risks of sedentary, non-educational screen time and limited exercise may also be considered. It is important, however, to take parents' work or family commitments into account to avoid creating any additional pressure on those who may already be struggling. When incorporating a focus on mental health and wellbeing within the virtual school day, individual needs should be considered as some students may require more support than others, so whole-group interventions may be less appropriate in some cases than focusing on those students who need the most support.

Younger students

While evidence on distance learning in younger students is scarce and indeed online learning was not used as part of distance learning arrangements for pre-school students in some parts of the world, such as in Oceania, where workpacks were provided, this report takes a closer look at what we know about young children's media use and their ability to learn from screens. It has been shown that excessive, sedentary, non-educational screen time can have a negative impact on children's socio-emotional and academic development and should be avoided. However, it is also clear that screens and media have very much become part of young children's lifeworlds and even children as young as three spend substantial time interacting with screens. It is hence essential to consider how this time can be spent most meaningfully so it benefits children's development.

Research discussed here shows that young children are generally not able to learn from passively watching videos but they can learn from educational television and apps that are active, engaging, interactive and meaningful. This is important when designing learning content for young learners. It is important to incorporate strategies to encourage learners to link what they have seen in a video to their own lives, for example, by encouraging them to look around the room they are currently in and finding objects that relate to what was just taught. Even if lessons are not taught live, incorporating instances of feedback and reactions can also encourage the engagement of young students. Given that television was used as an approach to distance learning for young students, it will be essential to analyse the type of content children were exposed to to determine how likely it is that they were able to learn from what was broadcast.

Co-viewing television shows, videos and apps have also been found to be effective but require substantial parental involvement, which was highlighted as a challenge in a context when parents also have to work from home. It may therefore be an activity that schools want to encourage for media use and reading outside the school context.

Young children's limited ability to work independently is highlighted in evidence from this crisis, which suggests that distance learning is particularly challenging to implement for young students. However, if early years settings had to close as part of crisis plans, the use of educational apps, television and e-books may ensure a certain level of educational continuity for our youngest learners and mitigate effects of the educational disruption.

Special Educational Needs and Disabilities

Finally, this report highlights that distance learning can be a viable alternative for students with SEND and can possibly even meet some of their needs better than face-to-face teaching but it comes with a range of challenges, such as a stronger reliance on the written word, which can be a particular challenge for students with developmental language disorder (DLD), dyslexia, Down's syndrome and visual impairments; additional distraction, which can be particularly difficult for students with ADHD; the need to operate a keyboard or mouse, a potential difficulty for students with Down's syndrome and certain physical disabilities, or small and blurry videos and audio lags that make it challenging for students who are deaf or hard of hearing and rely on lip-reading to hear what is said.

The report outlines a range of strategies that teachers and schools can adopt to support students with different SEND and it seems crucial that people designing and delivering online content familiarise themselves with the workings of assistive technology to ensure that learning content is indeed accessible to all students. Simple strategies such as making editable content instead of PDFs or scans available, providing descriptions of images on pages or providing audio instructions for students who may be struggling with the written word can be adopted relatively easily. It is crucial, however, that the learning objective of a lesson and concerns about potential barriers to achieving it should form the basis of planning for students with SEND. Additionally, while this report outlines some of the specific needs that children with various SEND may have in the online environment, the list is not exhaustive and each child will have individual needs and preferences that should be considered in planning. One illustrative example highlighted in this report is students with ASD in a study on online learning at university level. While some disliked collaborative learning, others thought it was beneficial. It is hence paramount not to jump to conclusions about children's needs based on their diagnosis.

Limitations of this report

The scope of this report was naturally limited. It is not a systematic review or a meta-analysis but draws on such evidence where it is available. The aim of this review was to provide a comprehensive picture of a broad range of themes relating to distance learning rather than responding to a specific research question.

The report also draws on evidence from the ongoing COVID-19 crisis, which is only starting to emerge and some of the cited evidence has not undergone full peer review and should thus be interpreted with caution. It is likely that the full impact of this crisis will only be known in a few years' time.

Furthermore, this report cites mainly English-speaking evidence, limiting its scope. Given the global scale of this crisis, evidence that is published in languages other than English would provide an important additional perspective and should be considered in any future research on this topic. While also considering emerging evidence from the ongoing crisis, this report draws largely on research from planned distance learning contexts that students opted into and teachers had substantial time to prepare for, which differs substantially from the emergency remote teaching that is currently taking place. This difference needs to be considered when planning or evaluating distance learning in the current context as not everything that works in well-designed research experiments on distance learning can necessarily be extrapolated to distance learning in a crisis situation.

Finally, while attempting to cover a broad range of issues relating to distance learning, this report is not exhaustive. Due to time constraints and limited available evidence in some areas, it does not look in detail at evidence on effective distance learning for practical subjects, such as arts, P.E. or D&T, it only considers a selection of SEND, and it does not look specifically at distance learning in further education or alternative provision or other specific contexts, to name a few, but some of the broad evidence presented here will also be applicable to these contexts. However, this should not be read as a reflection of priorities and these areas require urgent attention.

Introduction

Why is distance learning such an important topic to explore?

During the first wave of COVID-19 in 2020, country-wide school closures aimed at slowing the spread of the virus affected over 1.4 billion students. At the peak of school closures in April, 172 countries had closed their schools, with 84.8 per cent of enrolled learners worldwide unable to attend face-to-face lessons (UNESCO, 2021). Globally, countries reported an average of 50 lost days of in-person teaching and learning during the first lockdown, but this number differed depending on when in the school year school closures occurred (UNESCO, UNICEF and World Bank, 2020). In some of these countries, schools remained open for the children of key workers, such as medical professionals and supermarket workers. However, most began to be taught remotely.

During the second wave of COVID-19 in Autumn 2020, substantially fewer countries opted for country-wide school closures but they still affected 12.8 per cent of enrolled learners across 23 countries in November 2020, and roughly 40 per cent of learners were affected by partial school closures. These meant that specific year groups or school types were learning remotely as was the case, for example, in Slovakia where all secondary schools switched to distance learning (UNESCO 2021).

At the time of writing this report (January 2021), 30 countries, including the UK, have opted for country-wide school closures in an attempt to curb the spread of the virus, whilst others have opted for partial school closures (e.g. Italy and Poland), affecting nearly 15 per cent of enrolled learners across the world (i.e. over 250 million students). Others have reopened schools as planned after the winter break (e.g. France and Spain) (UNESCO 2021).

Even before these full or partial nationwide school closures, individual schools or year groups had to close and temporarily move to distance learning due to cases of COVID-19 in their student or teaching body, or due to staffing issues and logistical challenges caused by COVID-19. This scenario is likely to be repeated when schools reopen to all students again. Such temporary school closures are not accounted for in the UNESCO statistics but add to the overall number of students whose learning has been disrupted during the COVID-19 outbreak.

For example, attendance figures in state funded schools in England (Children's Commissioner, 2020) show that during the Autumn term of 2020, after schools reopened, an average of five days of learning was lost per pupil. These figures varied widely across different geographical areas, and attendance was worse affected in secondary schools compared with primary schools. In some local authorities, the

average number of days of missed learning was double that of other areas. Although data suggests that only 2.4 per cent of the children absent from school had a confirmed case of COVID-19, over 590,000 school students spent time self-isolating during the Autumn term, creating an urgent need for these students to have access to education from home so that they did not miss out compared with their peers who were receiving face-to-face instruction.

In another example, 165 schools in Germany were closed in November due to local COVID-19 outbreaks (Haas and Kunz, 2020). These circumstances created a unique situation whereby many schools were working within an ever-shifting and often unpredictable hybrid model of blended face-to-face and remote teaching.

This, again, is a scenario that is likely to continue until countries achieve herd immunity, which requires an estimated 60 per cent of the population to develop an immune response, either through a vaccine or through contracting the virus. Current figures indicate that around 12.1 per cent of people in England and less than 10 per cent of people in Wales, Scotland and Northern Ireland have antibodies against COVID-19, which is still far from the estimated necessary threshold (Armstrong, 2021). The speed at which this threshold can be reached will depend partly on the speed at which vaccination campaigns are rolled out, and it is important to be prepared for a scenario in which at least partial school closures, or closures of individual year groups or bubbles, remain a regular occurrence.

International approaches to distance learning during COVID-19

Data from a joint report by UNESCO, UNICEF and the World Bank (2020) with responses from 122 countries, shows that countries have relied on a range of distance learning approaches during the COVID-19 outbreak. While most countries have used a mix of education modalities, regional differences in the choices of distance learning were apparent. High-income countries mainly employed a combination of digital media and paper-based work packages, whilst television and radio transmissions dominated provision in low-income countries. This report will mainly concentrate on online learning as this is the approach that was most commonly used on average, world-wide and in the UK; but will also consider what we know from research about the ability of children – particularly the youngest – to learn from other media, such as television.

In China, authorities reviewed existing research to identify key pedagogical risks when moving to distance learning, and then tried to mitigate them. Challenges included teachers being overwhelmed with creating resources for distance learning, a lack of training for remote teaching pedagogy, and students not being accustomed to self-directed learning (McAleavy and Gorgen, 2020). In discussing online learning provision in India, one author noted that: '"[th]ere is no clear stipulation by the government in their educational policies about e-learning programs. There is a lack of standards for quality, quality control, development of e-resources, and e-content delivery."' (Dhawan, 2020, p. 15)

In England, in October 2020, government ministers used emergency powers to impose a legal duty on schools to provide remote education. The Department for Education stated that all school children attending state funded schools must be given immediate access to remote education if they need to self-isolate, or if restrictions require pupils to stay at home (DfE, 2020a). The temporary mandate also referenced expectations around the quality of remote education offered. These expectations included:

- that schools have a strong contingency plan in place for remote education provision
- the use of high quality online and offline resources and teaching videos
- the consistent use of online tools across the school, which allow for interaction, assessment and feedback
- setting meaningful and ambitious work each day in a number of subjects.

(DfE, 2020b)

In parallel, Oak National Academy, an online platform hosting 10,000 lessons and resources to support teachers working with students across all age ranges was launched. The platform covers a wide range of subjects and specialist lessons to support students with SEND. It is accompanied by a TeacherHub with additional resources to help teachers and schools to plan their lessons and online delivery.

Why is this report important and what does it add ?

One immediate challenge in this situation is to define what constitutes high-quality and appropriate distance education, given the broad range of learners, subjects and contexts involved. Much like teachers, researchers have also responded rapidly to this crisis, pulling together existing research evidence to support educators in identifying best practice for teaching at a distance.

There has been, however, a lack of focus on what we know about effective distance learning for younger students and students with SEND, as well as on students' mental health and wellbeing and their engagement during distance learning – a gap that this report seeks to address. This report also seeks to expand on previously presented research by including studies from the ongoing COVID-19 crisis that are rapidly becoming available, as well as qualitative case studies which provide valuable insights into the lived experiences of students in distance learning contexts.

This report is not a systematic review, nor a rapid evidence review on the effectiveness of distance learning, as these have already been conducted recently by other researchers and organisations (e.g. EEF, 2020; McAleavy and Gorgen, 2020) and some of their key findings will be summarised here, along with their limitations.

Therefore, rather than duplicate these, this report aims to narratively bring together existing findings from a range of international contexts, including from the current pandemic, so that they are more easily accessible for teachers and policymakers. In a follow-up report, these findings will then be considered alongside teachers' views of what worked best in distance learning during the COVID-19 crisis.

This may not be the last time that face-to-face education is interrupted and schools may want to continue offering some aspects of distance learning as more students return to school. It is therefore important to learn from the distance learning that has happened around the world to date, and to use it to plan and prepare for the future.

Terms and definitions

Distance learning

There are various terms which have been used to describe learning that takes place without the teacher and learner being physically present in the same room. These include remote learning, online learning, distance learning and e-learning.

Research indicates that this terminology is often used inconsistently, creating confusion over the specific characteristics of each type of learning, and making it problematic to perform meaningful cross-study comparisons (Moore et al., 2010).

In this report, our key focus is 'distance learning'. There is, as yet, no agreed common definition of distance learning used by researchers and practitioners; but it often describes providing access to learning for those who are geographically distant, using varying forms of instructional materials (Moore et al., 2010). Therefore, it can be seen as an umbrella term which incorporates online and e-learning as well as other approaches that teach children via television or radio, for example.

Throughout this report, the term 'distance learning' will be used to denote various types of learning which happen without the learner being face-to-face with the teacher, in the same physical space. This learning may or may not happen online, so whilst it encompasses online or e-learning, it also includes the use of textbooks, radio, television, worksheets and other offline activities which take place outside of the school classroom, as instructed by a teacher. Other terms such as online learning, remote learning and e-learning may also be used throughout this report when citing from other research which describes learning in this way.

Blended or hybrid learning
Blended or hybrid learning is usually defined as the combination of face-to-face and online learning (Wong et al., 2014). We will be using the term 'blended learning' in this report. Traditionally, this has typically involved students completing part of their course online and part of their course face-to-face. However, in synchronous blended learning settings, remote students join live lessons via video-conferencing software, whilst their peers attend the same lessons face-to-face. We use the term 'blended learning' to describe both situations where large groups of students are self-isolating and may engage in distance learning from home for a two-week period but attend school before and after that isolation period, and when teachers are simultaneously teaching students in school and streaming or recording the lesson for other students to watch live at home. Due to various circumstances during the COVID-19 crisis, teachers in many countries are in this position of teaching face-to-face classes whilst also teaching other students via distance learning. This situation is unique, but we draw from research into synchronous blended learning – mainly from university settings – in order to learn more about effective practice in this area.

Synchronous or 'live' online teaching
This term refers to the type of instruction where teachers and students are online at the same time, communicating and interacting via video, audio or in written form via online learning platforms or other means.

Asynchronous online teaching
This term refers to online teaching where teachers and students are not online at the same time and students engage in independent learning. Examples include pre-recorded videos; narrated PowerPoint presentations or recorded instructions that students can use for self-study; discussion forums that students can contribute to in their own time, or a group project that they can each work on independently.

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Distance learning

Although the position we find ourselves in during this pandemic is new to us, distance learning is not a new phenomenon. Distance learning can be traced back to as early as the 18th century, with lessons being posted to learners (Kentnor, 2015) and it has been available to students who live in remote parts of Australia for over 100 years (Fahraeus, 2004). The early 1900s saw the dawn of educational broadcasting via radio and later in the 1950s and 1960s, television was used to broadcast lessons (Kentnor, 2015). But its most rapid growth occurred in the late 1990s along with the online technological revolution and the introduction of e-learning. The e-learning industry grew 900 per cent from the year 2000 to 2019 (Pappas, 2019). In the USA alone, 4.6 million, or 32 per cent of students in public institutions participated in some form of distance education in 2017 (Bustamante, 2020), and in Uruguay, 71 per cent of primary school students learn English remotely via video conferencing; this was the case even prior to the COVID-19 outbreak (Stanley, 2019).

Online schools have existed for over a decade. Although they predominantly serve secondary school students, they also exist in both the UK and the USA for younger students. In 2015 in the USA, there were around 200 publicly funded online charter schools[1], also known as virtual charters, serving around 200,000 students. Half of these schools enrolled elementary and middle school students as well as high school students (Gill et al., 2015). Additionally, in China, distance learning has been used since 2003, as a way of making education more equitable in rural areas. The Distance Education Project for Rural Schools (DEPRS) was considered by Chinese educators to be the biggest ICT project in the world, serving over 400,000 schools (McQuaide, 2009). There is therefore a wealth of existing practice, experience and research on which we can draw to learn more about distance education, and this report aims to summarise and synthesise such research.

[1] Charter schools in the US have more autonomy in the operation and management of their schools but commit to obtaining specific educational objectives (National Charter School Resource Centre, n.d.).

However, this comes with an important caveat: we must exercise caution when comparing what takes place during planned online teaching, with what takes place during a global crisis.

Although distance learning was well established in many countries when the COVID-19 pandemic took hold, in these unprecedented circumstances the shift away from face-to-face education happened almost overnight in many cases, with little opportunity to plan and prepare for the transition. Teachers who had never taught remotely before were expected to do so, whilst schools or countries without distance learning systems already in place grappled to rapidly choose which platforms and approaches to utilise, and how to support teachers, students and parents to use them.

Research conducted with teachers in the UK into their views on teaching during the pandemic has documented the sense of pride felt by the profession with regard to how adaptable and agile teachers were in making this rapid transition (Müller and Goldenberg, 2020b). Nevertheless, it highlighted many challenges including the lack of internet access and devices for many families, safeguarding issues around teaching and learning online, and the need for teacher training in new systems and technologies.

Therefore, it has been raised that it is important to distinguish between carefully planned and resourced online learning and emergency remote teaching (ERT), which has been rapidly constructed with minimal time and resources, as a temporary measure (Hodges et al., 2020; Bozkurt et al., 2020). Using research evidence based on courses which were specially designed to take place online, opted into by students and facilitated by teachers with adequate training and preparation, and applying these findings to a pandemic situation in which ERT is in place, could lead to misleading guidance. Accordingly, while we aim to use existing distance learning research to extrapolate useful learnings for the current context, we also recognise the importance of drawing on research that has been conducted during the pandemic, and reflects the very specific challenges presented by the current circumstances.

Effectiveness of distance learning

Existing research on the efficacy of distance learning is mixed. Some research evidence suggests that learning remotely can be just as effective as face-to-face teaching and in some cases, academic progress is better when students are taught online (EEF, 2020). A meta-analysis of over 500 research papers on distance learning found that some courses using distance education technology – language learning courses, for example – were found to show a small improvement in performance compared with traditional face-to-face teaching, whilst for some other courses such as natural sciences, there was little difference or a slight negative impact (Allen et al., 2004). Whether courses were synchronous or asynchronous did not appear to influence the performance of students. A more recent meta-analysis reported equivalent outcomes for students in purely online and purely face-to-face conditions, with the best student performance seen in blended approaches which combine both online and face-to-face elements (Means et al., 2009). Although these analyses were largely based on research studies conducted with older students, a meta-analysis looking at distance learning with K-12 students (ages 4–16) in America reported similar results, claiming that distance education can have the same effect on measures of student academic achievement as face-to-face instruction (Cavanaugh et al., 2004).

However, other research does not depict distance learning so positively. It suggests that teachers perceive distance instruction negatively due to concerns over diminished contact with students and a loss of control over the learning environment (Mottet, 2000). In one study, student satisfaction was shown to be 22 per cent lower in distance education courses compared with traditional face-to-face courses (Allen et al., 2002). An evaluation of online charter schools in 17 states of America and the district of Columbia found that students taught in online charter schools performed significantly worse than students of a similar ability and socioeconomic status who were taught face-to-face in traditional state schools (Woodworth et al., 2015). The study found that on average, the difference in attainment growth of students enrolled in online charters corresponded to 180 fewer days of learning in maths and 72 fewer days of learning

in reading compared with their counterparts in traditional state 'brick and mortar' schools. Students in online charters also performed less well than their counterparts in charter schools which provide face-to-face learning, suggesting that the differences in performance are due to the online nature of the education provided, rather than whether the school is state-run or a charter. (Woodworth et al., 2015). However, the authors note that these average figures are likely hiding some variation in the performance of individual schools or districts, making it difficult to draw any solid conclusions about the effectiveness of online charter schools as a whole, as some will perform better, whilst others will perform worse than the average.

A more recent study (CREDO, 2019) took a more detailed look at Charter Schools in Idaho and did not find any significant difference for reading but an equivalent of about 59 fewer days of learning for maths compared to 'brick and mortar' state schools, which is still smaller than the learning loss that the authors observed at a national level in their previous work. The study also shows that students in online charter schools lag behind their peers in 'brick and mortar' charter schools in both reading and maths. Academic growth in both reading and maths was greater for students in 'brick and mortar' charter schools than their peers in state schools in this study.

While many online charter schools have been criticised for poor academic results (Waters et al., 2014), there is a minority of examples where, based on regional data, online students outperform their state average and are more likely to graduate than students in other local schools (Doyle, 2019). However, the case studies from these schools are not underpinned by robust research methods; for example, matching the cohorts of students in online and face-to-face schools.

Unpicking which strategies and techniques underpin the success of distance learning is key, and a central aim of this report.

Pedagogical features of effective distance learning

Studies have sought to explore whether variables such as the type of media used, whether activities are instructor directed or independent, and whether lessons are 'live' or not, make a difference to student performance. However, some research suggests that variations in the way that distance learning is implemented do not significantly affect learning outcomes (Means et al., 2009).

According to a rapid evidence review by the Education Endowment Foundation ((EEF) EEF, 2020) teaching quality is more important than how lessons are delivered. Thus, there is no clear difference in student performance between formats such as, for example, synchronous and asynchronous teaching (Allen et al., 2004; EEF, 2020). However, incorporating effective strategies which have a positive impact in the physical classroom are likely to also be effective in a remote learning context. This was echoed in guidance from the Department for Education (DfE, 2020c) which advised schools to maintain focus on features of effective teaching practice when adapting teaching for remote learning, and to build formative assessment and feedback into remote teaching approaches.

Some researchers and practitioners have cautioned against focusing too much on technology-centred solutions (Bozkurt et al., 2020). They assert that technology is a tool to be learnt with, rather than a cure for all of education's problems, and that a pedagogy-centric approach is more likely to lead to distance learning that will continue to be used effectively in the long term. Thus, this section of the report focuses specifically on aspects of pedagogy which, when implemented effectively in distance learning, should have a positive impact on learners. These pedagogical approaches are worth investing time in, as they can be embedded no matter the type of technology that is being used, and will also be effective during face-to-face teaching.

There is a wide range of pedagogical approaches that can be effectively transferred to an online learning context. However, three areas that may be worthy of particular consideration – as they are areas for which there is a reasonable amount of research evidence – are scaffolding and metacognition, collaborative learning, and assessment

and feedback.

Each of these will be explored in detail below as exemplars, with supporting research evidence.

Scaffolding and metacognition

Scaffolding refers to a variety of supportive instructional strategies which guide learners in moving gradually from one stage of their learning to the next, and will be a very familiar concept to all teachers. The aim is to provide students with enough support to enable progression from doing something with support, to achieving it alone. A good analogy used by Doo et al. (2020) is that of teaching a child to ride a bike: by first using stabiliser wheels, then holding the back of the saddle whilst they pedal, and then gradually letting go so that they can ride independently. Thus the teacher tends to model and support the desired strategy before gradually shifting responsibility to the learner. Students progress towards greater understanding and independence as they require fewer scaffolds over time.

In a distance learning context, scaffolds are often mediated by technology but continue to be similar to those used in face-to-face teaching. One meta-analysis of instructional scaffolding in online learning environments (Jumnaat et al., 2014) identified four main types of online scaffolding: procedural, conceptual, strategic and metacognitive – each with their own purposes in supporting the learning process. While procedural scaffolding supports students in using the tools and resources available to them, conceptual scaffolding guides them to prioritise key concepts. Strategic scaffolding encourages students to consider alternative methods and strategies for problem solving, and metacognitive scaffolds guide students' thought processes.

A study of scaffolding in higher education found it has a statistically significant effect on online- learning outcomes (Doo et al., 2020). Some studies suggest that scaffolding is particularly effective for pupils from low income families, although the evidence is not completely clear in this regard (EEF, 2020).

Instructional scaffolding is an interactive and reciprocal process between learner and teacher. The learner is active in this process and needs to engage with the scaffolds in order to make progress (Delen et al., 2014). However, this doesn't necessarily mean that scaffolding has to be provided 'live' by a teacher. Instructional scaffolds in a distance learning environment may include instructional videos and demonstrations; glossaries; word banks; supportive prompts such as sentence starters or questions; rubrics; links to additional resources and exemplar models of work. Some online courses offer scaffolding by adaptively releasing instructional material; releasing a different amount or type of information or instruction depending on the student's performance. They may also scaffold larger assignments by breaking them down into smaller sub-assignments (Wandler and Imbriale, 2017).

Some scaffolding focuses specifically on supporting students' development of self-regulation and metacognition. Research suggests that this type of scaffolding is particularly effective (Doo et al., 2020; Kim et al., 2019). Several studies have indicated that metacognitive and strategic scaffolding are important features of ICT based learning (EEF, 2020). Yet a report conducted during the COVID-19 crisis indicates that very few teachers in England were teaching metacognitive strategies in May 2020, when distance learning was in place for the vast majority of students (Lucas et al., 2020).

Metacognitive scaffolds are prompts, questions, models and sequenced interactions which guide students' thinking about their learning and encourage them to implement metacognitive strategies such as planning and managing tasks, reviewing and evaluating learning, and reflecting on the learning process. This may be particularly important in distance learning contexts, wherein students have to engage in self-regulation; sustaining their own attention, pacing and motivating themselves, and maintaining high standards of learning without having a teacher physically present to supervise them. A meta-analysis of effective practice in online learning found that triggering learners to reflect and self-monitor their understanding is effective when

students are working online individually (Means et al., 2009). However, research suggests that the timing and frequency of metacognitive prompts is important and that they will be more effective if used continuously throughout a learning course rather than only at the start of a term or sequence of work (Wandler and Imbriale, 2017).

In a meta-analysis of the effects of distance learning on four to 16 year olds, autonomy and self-regulation are cited as characteristics which set successful distance learners apart (Cavanaugh et al., 2004). The analysis asserts that for distance learning, teachers must equip their students with the metacognitive and self-regulation skills needed to work independently. Thus, metacognitive scaffolding may be particularly important for students who struggle with distance learning, due to the decreased supervision from teachers and a reliance on learner independence.

A study of online video-based learning involving university students found that supplementing an instructional video with interactive scaffolds such as note taking tools, links to supplemental resources and practice questions for self-evaluation, helped students to engage with the learning material for longer and recall more information from the video (Delen et al., 2014). Adding self-evaluation questions might serve to support retrieval practice, for example, and thus encourage and embed effective learning practice.

Another study looked at how metacognitive prompts can be embedded online during problem solving activities in physics (Osman, 2010). Results showed that metacognitive prompts enabled students to reflect more on their thought processes, recognise the importance of planning and improve accuracy through checking; leading to improved problem-solving skills and higher order thinking. And so, whereas historically computer-based programmes were primarily used for drill-and-practice activities, advances in technology mean that computer-based learning environments can now also potentially develop metacognitive thinking. Some argue that carefully programmed computer-based learning provides a personalised, systematic and detailed way of tracking and guiding students' metacognitive thinking, which makes it an efficient method for helping students to develop in this area (Verschaffel et al., 2019).

A systematic review of computer-based maths learning indicates that programs which combine ICT and metacognitive pedagogies generally enhance learning and achievement in maths more so than programs without elements of metacognition (Verschaffel et al., 2019). There is also some evidence that these approaches work with younger children, too; three of the studies considered in the Verschaffel et al. (2019) review were conducted with children aged four to six. Effects were compared between an ICT-based maths program which incorporated metacognition, and one which did not. The metacognitive strategies taught were basic planning, monitoring and reflection strategies – taught through prompts, questions and demonstrations which were embedded in the online maths program. In two of the studies, the metacognitive element had a significant positive effect on maths learning, compared with the non-metacognitive maths program (Verschaffel et al., 2019). In the third study, a positive effect was seen on literacy but not on maths learning. However, it should be noted that participation in the maths program happened alongside face-to-face teaching and that, therefore, teachers were able to reinforce and embed metacognitive strategies in class. It is unclear whether the metacognitive pedagogy in the program would have been as effective without face-to-face supplementation. One study also observed a cognitive overload resulting from the use of prompts (Shamir and Lifshitz cited in Verschaffel et al., 2019).

Another study looked at a related but distinct form of scaffolding that may be relevant in the context of distance learning (Tuckman, 2005). Undergraduate students of a web-based study skills course were either enrolled in the regular online course, or one with additional motivational scaffolds. These motivational scaffolds consisted of:

- an online, 60-minute study skills support group each week, where students were helped to stay on task by supporting and coaching one another to prepare and review weekly to-do checklists

- a weekly online meeting with the course instructor.

These scaffolds were phased out during the second half of the course. Results showed that students who were identified as procrastinators performed better in the motivational scaffold course, whereas students who did not have issues with procrastination performed equally in both. The high procrastinating students actually went from being the worst performers to the best, when motivational scaffolding was provided (Tuckman, 2005), suggesting that the scaffolds enabled them to fulfil their otherwise untapped learning potential.

Recommendations for teachers and school leaders

- Structure and scaffold learning step-by-step as you would for in-class lessons. Provide examples, supports and prompts which fade over time as students become more confident.
- Identify students who may struggle with the lack of structure and supervision in distance learning. How can they be supported to self-regulate using metacognitive scaffolding? Consider the use of peer coaching, metacognitive prompts and checklists as well as explicitly teaching effective study skills.
- Provide reflective questions for students which support self-regulation and metacognition, such as the following:

  Am I concentrating well and being productive today? (Why/why not?)

  Do I understand the learning material?

  What has been difficult?

  What can I use to help me if I am stuck?
- Provide exemplar models of work for students to refer to, and resources which enable them to assess their own learning.
- Motivational scaffolding has been found to be effective with adult learners and could be considered in the context of distance learning with children.

Collaborative learning

Collaboration and opportunities for peer interactions have been found to improve learning outcomes and provide motivation in a distance learning environment (EEF, 2020), perhaps owing to feeling a sense of connectedness or relatedness to others, which is thought to be a key component of intrinsic motivation (Deci and Ryan, 2012).

Given that a feeling of isolation in students is one of the recognised challenges of implementing online learning (Croft and Grant 2010; Mbukusa et al., 2017), collaboration and peer interactions may mitigate feelings of loneliness and allow students to maintain a sense of community. Indeed, some researchers have suggested that in distance education, particularly in an emergency situation, priority should be given to building support communities and encouraging students to share knowledge and experiences in order to create meaningful learning processes (Bozhurt, 2020).

Collaborative learning is thought to be effective as students can share and co-construct knowledge through social interactions, reducing individual cognitive load and thus leading to deeper processing of information (Chen et al., 2019). Such collaboration does not need to be face-to-face in order to be effective. Evidence suggests that collaborative learning in online environments can be more effective than individual learning (AITSL, 2020; Means et al., 2010) and has a significant positive effect on knowledge gain – as measured by standardised tests; skill acquisition – such as the development of critical thinking and problem solving skills; and students' perceptions of the course, according to an analysis of 425 studies on computer-based collaborative learning (Chen et al., 2018). The majority of these studies were conducted at university level, although there are some primary and secondary school studies included which showed equally positive effects. There was also no significant

variance in effects between different subject areas, suggesting that collaboration may be an effective strategy across all age groups and subject disciplines.

In one review exploring different types of interaction during distance learning in higher education settings, student-to-student interaction was found to have the largest impact on student outcomes (Bernard et al., 2009). And other research has suggested that a high level of interaction positively influences the effectiveness of any distance learning course and is key to effective learning (Kearsley 1995; Keegan 1998, cited in Miltiadou and Savenye, 2003). However, the quality of interactions is important, and research suggests that these interactions should be well-integrated and meaningful rather than forced or over-used, which could mean they become negatively perceived by students (AITSL, 2020). Some research suggests that students interact with one another more frequently as they become more comfortable and confident using the technology available.

Peer assessment and peer evaluation may be particularly effective types of interaction. A meta-analysis of 23 studies in blended learning environments which looked at the effects of peer evaluation, found that anonymous marking of work by peers has a positive impact on learning achievement, and the effect size is largest when peer markers are given training (Cui and Zheng, 2018).

Other opportunities for interaction between peers in a distance education environment may include peer review activities, working collaboratively on tasks or projects, paired and group discussion or debate and group presentations (Riggs, 2020).

However, facilitating effective collaboration during distance learning may be a challenge. A study from New Zealand (Yates et al., 2020), looking at high school students' experiences of online learning during COVID-19, found that 67 per cent of students felt that online collaboration with peers was less helpful than collaboration that takes place in class. Reasons cited for preferring in-class collaboration included proximity to teachers and peers and more immediate support, as well as the spontaneity of classroom discussions which allow for ideas to be shared and discussed more informally. Students felt that online platforms such as Zoom can make collaboration feel awkward and uncomfortable and that teachers tend to dominate discussions. Others commented that when peers turn off their cameras it makes it more difficult to collaborate and communicate. Students who particularly enjoyed online collaboration talked about the effectiveness of using familiar platforms and technology, such as social media and WhatsApp video calls, to communicate and work together, as well as the effectiveness of small group discussions and projects.

Recent research from Estonia also asserts that engaging school-aged students in collaboration may be more challenging than the research from adult learner contexts suggests (Rannastu-Avalos and Siiman, 2020). Science teachers reported difficulties in supporting student collaboration from a distance, with difficulty in establishing social presence cited as a particular barrier.

Social presence is thought to be a key aspect of online learning, and although there is lack of a shared single definition, it is broadly considered to be the degree to which someone using a communication medium feels that they are 'with' another person, or connected to someone else (Lowenthal, 2010). Learning online or at a distance can either be social or isolating. Social presence theory, developed in the 1970s, attempts to explain the effect that different communication media might have on the way people interact and connect. In distance learning contexts with low social presence, students do not feel connected with each other and do not feel as though other learners are 'real people'. Such environments might be those where learners cannot use visual or auditory cues when communicating with each other, where learning feels impersonal and where there are long delays between messages and responses (Kear, 2010). Creating a warm and sociable online community helps to increase social presence.

One set of guidelines for quality online teaching developed in the US (NSQ, 2019) suggests that the online teacher should use digital pedagogical tools which support

communication and collaboration, and that they should nurture learner relationships and encourage interaction. Examples given include using discussion boards and forums, small group work, and asynchronous interaction such as emails and blogs as well as live sessions. They also suggest that that the teacher will need to create expectations and guidelines regarding how students should interact appropriately online; modelling and sharing these, whilst monitoring any individuals who do not appear to be participating, so that they can be supported to do so.

However, while these interaction opportunities may be possible using online technologies, we know that in the current context, not all distance learning takes place online and it needs to be recognised that it is more challenging to create opportunities for collaboration to take place at a distance without the use of technology. A resulting lack of connection between students is likely going to impact the feeling of community in a class and may need to be addressed when the majority of students return to school.

Recommendations for teachers and school leaders

- Consider how social presence can be cultivated in distance learning environments by providing meaningful opportunities for students to interact with each other to support their learning and address potential feelings of isolation.
- Encourage students to work collaboratively on tasks and projects, perhaps by assigning breakout groups during video calls if live lessons are being used, working collaboratively on a piece of work, exchanging in discussion forums or through pre-recorded videos during asynchronous teaching.
- Explore ways for students to share work with one another and give peer feedback.
- Develop and share clear guidelines regarding online interaction so that students know what is expected from them in terms of the quantity and quality of interactions.
- If opportunities for collaborative learning were limited during distance learning, consider dedicating some time to rebuilding connections in the classroom community when all students return to school.

Assessment and feedback

Formative assessment is crucial in providing regular feedback to help students improve and to inform future teaching. Therefore in order to maintain academic achievement, it is important that this continues to take place during distance and blended learning.

During distance learning, teachers are less able to rely on incidental formative assessment opportunities and, therefore, will have to be more systematic and intentional about how and when assessment will take place.

Research suggests that online learners may have fewer opportunities to receive feedback than students who learn in face-to-face classrooms (Means et al., 2009). Yet others suggest that online assessments have advantages over classroom-based assessments; namely that the assessments can be taken by the student at any time, can be taken repeatedly, and can provide instant feedback (Zakrzewski and Bull, cited in Wang, 2006).

The Centre for Education Statistics and Evaluation (CESE) suggests that formative assessment when teaching remotely could include the use of exit tickets, online quizzes and student-created portfolios of work (CESE, 2020). Whereas the 'Remote education good practice' guide published online by the Department for Education (DfE) suggests that schools use software such as Google Forms, Kahoot, ClassKick, Socrative and EdPuzzle for questioning and discussion, and live feedback and marking (DfE, 2020d).

A number of strategies used for formative assessment have been found to support student achievement in online learning contexts. Formative online self-assessment was more effective than traditional testing in a study of 12–13 year old Taiwanese students participating in an online biology course (Wang et al., 2006). In this online assessment, students were informed when they got a question wrong, and were subsequently provided with further resources to explore in order to find the correct answer. In a study of undergraduate students, the use of an online multiple-choice assessment – which gave instant feedback on how to improve areas of weakness – was found to improve performance in an end-of-course summative assessment (Buchanan, 2000). As different types of formative assessment may be more or less effective for different types of learner, embedding a range of assessment strategies is thought to lead to the greatest effects, and is preferable to sticking to one rigid approach (Wang, 2006).

Yet it is not enough to just administer computerised assessments. Questioning, listening, assessing and advising are thought to enable teaching presence to be developed and maintained when students are learning remotely (McAleavy and Gorgen, 2020). A strong sense of teacher presence is key when teaching in an online context, according to a conceptual model of online learning developed by Canadian researchers (Anderson, 2004). This model – based on higher education – acknowledges that research on assessment in distance education suggests that rapid feedback is important for student motivation and understanding, yet also warns that due to the instantaneous nature of online learning, students may develop unrealistic expectations about the volume and speed of feedback that they will receive. Thus, suggestions are made to communicate appropriate timelines and expectations with students (Anderson, 2004).

Summative assessments can also prove challenging during distance learning. Not all students will be able to access online assessments, understand the instructions and use any technology needed to complete the assessment. This creates equity challenges as well as logistical ones (CESE, 2020).

Recommendations for teachers and school leaders

- Encourage teachers to plan and discuss how and when assessment and feedback will take place throughout sequences of learning.
- Use a range of strategies for formative assessment. These may include online quizzes, live discussions and asynchronous questioning using messaging platforms, as well as asking students to submit photographs or portfolios of work.
- Consider how to provide feedback for students whilst managing workload. In some cases, this may involve utilising peer feedback, or providing group feedback to cover key points.

While both the EEF's Rapid Evidence Review (2020) and the summary of effective pedagogical strategies above indicate that strategies which are effective in the face-to-face classroom are likely to translate well into the distance classroom, there appear to be some additional skills and strategies that are specific to remote teaching settings. In addition to technological skills – which include the ability to manage learning platform and video conferencing software but also awareness about volume levels at the students' end – Pintos (2019) found that telepresence, i.e. 'having good presence on the screen' can be important (Pintos, 2019, p. 46). Using body language effectively, through exaggerated gestures and moving around rather than sitting in front of the screen, could further help in attracting and maintaining younger students' attention. Further ways of managing engagement and motivation specifically in a distance learning environment are discussed in the following section.

Limitations of research on effective distance learning

Overall it is acknowledged that there is a scarcity of rigorous research about specific distance learning tools and programmes, and that more experimental and quasi-experimental research which looks at distance education across a range of ages and subject areas is needed (NYU 2020; EEF, 2020). The studies which do exist are often rated as being low in quality (EEF, 2020) and there is a lack of research from low- and middle-income countries (McAleavy and Gorgen, 2020).

Much previous research has attempted to measure the effectiveness of online learning by comparing online versions of a course with face-to-face learning (a media comparison study). However, as Hodges et al. (2020) assert in their paper, these studies are often ineffective as they have too many confounding variables and do not adequately consider the individual characteristics of courses, the needs of learners, and the differing ways in which individuals interact with different media. They also give little thought to psychological learning theories and the individual characteristics of courses.

Furthermore, the vast majority of research on 'distance learning' is based on 'online learning' specifically. Yet we know that many areas around the world do not have access to the internet, and even in developed countries, individual homes may not have adequate devices or internet connection enabling them to engage with online learning. There is very little research available which explores the effectiveness of distance learning using other strategies such as text books, work packs and television or radio broadcasts. This is particularly problematic when trying to explore the best distance learning strategies for younger students, who may not be able to engage independently with online learning.

Even though there are some interesting examples of distance learning from younger learners to be found (see below), the lack of research based on younger children has been noted (EEF, 2020).

It is thought that younger children in particular may need social interaction for their learning. This is highlighted by research indicating that young infants can learn from live exposure to a foreign language when the adult speaker is in the same room as them or on a live interactive video call, but not from a prerecorded adult voice whereby there is no social interaction. Therefore it is imperative to explore the effects of distance learning on our youngest students, so as to ascertain how best to support their rapid development during times of school closure. While research on distance learning specifically is still seriously lacking, a growing body of evidence in the field of digital learning through television, tablets and apps can provide important insights on learning processes in young children using new technologies.

However, gaps in the research base extend beyond the need for studies with younger learners. Existing studies are also distributed unevenly across subject areas, with little to no research available on teaching the arts and practical subjects such as PE, DT and practical science remotely. This lack of evidence across different age ranges and disciplines makes it problematic to obtain reliable information about effect sizes. There is not enough data in each 'category' of learning to make meaningful comparisons and draw conclusions on whether strategies are applicable across different contexts.

The limited research that does exist regarding different subject areas suggests that course content does affect how well students perform using distance learning. In one meta-analysis, courses in foreign languages showed the greatest advantage for distance learning compared with face-to-face teaching. This is thought to be because of the opportunities it offered to interact on a regular basis with a native speaker of the language (Allen et al., 2014). So for some subjects, distance learning may provide enhanced opportunities for learning, whereas other disciplines such as arts subjects may suffer more in the transition away from face-to-face teaching.

Furthermore, what is identified as best practice during planned distance learning may not necessarily work as well in the context of emergency remote teaching

wherein both students and teachers need to get to grips with the mechanics of remote teaching that neither have opted into, and the global context may create an environment that is not necessarily conducive to a focus on learning.

Drawing generalised conclusions about the effectiveness of distance learning as a whole is problematic. Studies are largely heterogeneous, using different media and technologies, for different subject areas and with different aged students. This makes it very difficult to synthesise results from different studies and give a definitive answer about whether distance learning is effective or not. The short answer is most likely: "it depends". Experiences of distance teaching and learning will vary widely across countries, schools, and even between individual students, depending on their personal circumstances.

Although it is not possible to make generalisations about whether or not distance learning is effective, in drawing upon research studies and evidence reviews, it is possible to extrapolate the common features of distance learning that seems to be successful. The following section will explore these pedagogical features of best practice.

(Synchronous) blended learning

The section above looked in detail at evidence from contexts where all students joined lessons and interacted with their peers and teachers from a distance, which is the case currently for most students in England. However, during this pandemic and as schools will reopen to more students, some schools may opt for a blended approach where students who are self-isolating join their usual lessons, which are taking place in school, from home. This section will therefore present some existing research on blended learning and discuss how this evidence may inform teaching in the current context. This is not an attempt to summarise the whole body of the extensive literature on blended learning but rather a focus on aspects of this distance learning approach that may be particularly relevant for schools in the current context and the future.

Blended learning is usually defined as the combination of face-to-face and online learning (Wong et al., 2014), with some learning taking place face-to-face and other elements taking place online.

Anthony et al. (2019, p. 4) outline the sorts of face-to-face and online activities that students might engage in during blended learning as follows:

Face-to-face learning

- classroom lectures
- individual/group discussions
- laboratory activities
- presentations
- student-student interactions
- student-teacher interactions
- student assessment and feedback

Online learning

- individual learning activities
- collaborative learning activities
- web-based training
- online tutorials, blog and chat rooms
- discussion board activities
- recorded videos and lectures
- online assessment and feedback

In this approach, the activities students engage with are often complementary, with the online environment providing opportunities for a more personalised learning experience as students can, for example, access recorded content again and complete individualised tasks. Schools may, in the future, wish to continue to use some of the materials and online learning platforms they have developed as part of distance learning, to enable a blended learning approach. Students could, for example, access recordings of modelled maths problems that have been created as part of current distance learning provision, to repeat content or engage in collaborative learning by working together on a writing project. A blended learning environment may also facilitate access to learning materials for students who are absent due to illness or exclusion. However, in order for workload to remain manageable, such blended learning provision would need to be the product of cross-school and cross-departmental collaborations.

Blended synchronous learning takes place when students are taught simultaneously both in-class and via video-conferencing software. Bower et al. (2015) define blended synchronous learning as 'learning and teaching where remote students participate in face-to-face classes by means of rich-media synchronous technologies such as video conferencing, web conferencing or virtual worlds' (Bower et al., 2015, p. 1). Other commonly used terms to describe this type of learning setting include synchronous hybrid learning or 'Here or There' instruction (e.g. Raes et al. 2020a), but we will use the term blended synchronous learning here.

As the definition above suggests, blended synchronous learning environments typically use a range of technological innovation – video cameras, additional screens, microphones and online learning platforms, for example – to ensure a comparable learning experience for on- and off-campus students. Raes et al. (2020a) even mention 'room controllers' that assist teachers during lectures by muting and unmuting remote students, and following up on chats or launch quizzes. This kind of setup and tool use differs substantially from the situation most teachers are facing during the current pandemic, which means that findings need to be treated with caution and cannot directly be applied to current settings. But some of the principles and issues may be able to inform planning for (synchronous) blended learning in schools.

Similarly to research on distance learning, evidence from school settings is scarce and the majority of findings stem from higher education settings where some students opt for distance learning while others stay on campus. This section will therefore mainly draw on a recent systematic review and on studies from the university sector; this difference in context needs to be considered when looking to apply findings to schools.

Raes et al. (2020a) conducted a systematic review on the benefits, challenges and design principles of synchronous blended learning and summarised 47 studies in which face-to-face elements were combined with teaching off-site students at the same time. Studies that focused exclusively on remote teaching were excluded. While the review aimed to include studies on all age groups, only one study (Anastasiades et al., 2010) from a school setting was found and included.

Anastasiades et al. (2010) investigated synchronous blended learning in two primary schools in Greece. In their study, 46 students and four teachers collaborated remotely via video conferencing to work on a project relating to climate change.

Students in this study worked together across two settings to develop ideas for a joint video project on climate change. The project involved one face-to-face meeting but apart from that, students remained in their respective locations. Overall, Anastasiades et al. (2010) found that students were satisfied with the synchronous blended learning experience but would not want their whole teaching to move to this form of instruction. Some students could imagine a combination of traditional and blended methods. Interestingly, students felt that the synchronous blended learning experience brought them closer to their classmates but also wanted to meet their remote peers. Students also appreciated the interactive nature of the activities.

This study hence highlights that synchronous blended learning is possible in a

primary school context and that it can have certain benefits. But it should be borne in mind that students in this particular study had support from their local teachers and peers, which students who join lessons from home would not have. Furthermore, this project was only one part of students' educational experience, so conclusions about implications for full-time blended learning are difficult to draw based on this study.

Potential benefits of synchronous blended learning
Raes et al. (2020) identified a number of organisational and pedagogical benefits of blended synchronous learning.

Organisational benefits
Organisational benefits include the possibility to branch out to more prospective students by offering a combination of face-to-face and off-site learning, thereby addressing declining student numbers. Furthermore, institutions can offer more specific courses that are usually taught at specific locations, to a wider range of students; consult leading experts in a field more easily, and respond to students' interests by matching them to said experts. Blended virtual classrooms could also potentially address workload issues, as the same content does not need to be taught twice at different locations or at different times. Finally, possibly the biggest benefit of such classrooms is the flexibility that they offer to students. While some students may choose to attend the class in person, others who might have to juggle family or work commitments with their education, might find it easier to attend a class virtually. This arguably leads to more democratic access to education as a wider, more diverse range of students can be matched with the best available experts in their fields.

Pedagogical benefits
According to Raes et al.'s review (2020a), the inclusion of a more diverse student and teaching body also means that hybrid virtual classrooms can come with potential pedagogical benefits. By connecting with teachers and students from outside their organisation, students can be exposed to a wider range of views, which might challenge and broaden their perspectives. Students may be encouraged to work with others across the world, and traditionally under-represented groups might be able to access education in this way. It also allows students to continue to access their learning when they otherwise might have had to miss a specific lesson or longer stretch of learning, due to, for example, an injury or family commitments, which might keep them away from campus.

According to Raes et al. (2020a), only a few studies have investigated the impact of blended learning on student outcomes. But those that have, found little to no negative effect, and similar student outcomes when comparing students in blended and traditional settings.

Clearly, a number of the benefits above apply less in a school setting, whilst others apply both currently and potentially in the future. For example, organisational benefits may be less applicable to school settings, even though some may apply to shrinking schools and those unable to hire specialist teachers due to limited resources or small cohorts. Whereas one can see how the pedagogical benefits of being able to connect to and work with others beyond one's immediate context may be a potential future benefit of blended learning, if it was to be adopted in schools more widely.

During the current crisis, synchronous blended learning provides the clear benefit of access to education for students who are shielding or isolating; although the lack of necessary equipment and technological support means that the context of planned blended learning at university level is difficult to compare with the current situation in schools.

One can also see some potential benefits of blended learning environments beyond the current pandemic if adequate support and equipment becomes available. For example, students in remote locations; those with long-term health issues or SEND that can make it challenging for them to attend face-to-face teaching; those with caring responsibilities, or children from traveling communities, could all benefit from full- or part-time access to synchronous blended learning environments, which would still allow them to feel part of a learning community whilst accessing the learning

content from home, the hospital or on the road. Synchronous blended learning environments could therefore complement existing provision – through hospital schools, for example – and diversify the offer children and young adults have access to. However, despite a range of potential benefits, blended learning also comes with a number of challenges that are discussed below.

Potential challenges of synchronous blended learning
There are a number of challenges related to synchronous blended learning, both for teachers and students.

Challenges for teachers
One inherent challenge with teaching in a synchronous blended learning environment comes with mastering the necessary technology, whilst others are related to the specific teaching skills that are needed in these new environments. In their evaluation of the Global Classroom Model at an adult learning centre in Denmark, where students have the flexibility to join lessons in the physical classroom or from home, Weitze et al. (2013) found that teachers need to establish new ways of ensuring that all students – those in class and those joining online – receive the same level of attention and that they all have the chance to contribute. Teachers also need to make sure that all learning materials are uploaded before the start of the lesson, adding an additional step to their lesson preparation that may not be required in face-to-face teaching.

Weitze et al. (2013) also found that teachers experienced an additional mental load when teaching in blended environments due to the need to keep an eye on various channels of communication; making sure not to move out of the video frame so that students online can see them; finding a middle ground in terms of speed of delivery that would account for any lags in transmission yet not be tedious for on-campus students, and making sure that all students get an equal opportunity to contribute.

Teachers in Weitze et al.'s study also noted that they sometimes found it challenging to read facial expressions of students who joined their lessons online, particularly with bad lighting, and to find a good balance between trusting that students were still following the lesson despite having turned their cameras off, and enforcing the requirement that students had to be present for a minimum of 80 per cent of a lesson to validate it.

Challenges for students
Similarly to teachers, students may also take some time getting to grips with the technology required for synchronous blended learning (Weitze et al., 2013). This needs to be taken into account so that enough time is planned at the start of a synchronous blended learning sequence for both teachers and students to familiarise themselves with the new technology. Problems with technology can also be frustrating for remote students as they rely on it to join their lessons. On the flipside, in-class students can feel neglected while technical issues for remote students are being attended to by the teacher (Huang et al., 2017).

While remote students in the study noted that, overall, the technology allowed them to feel like they were part of the lesson, some found it difficult to join in the conversation without feeling like they were interrupting the flow. In the transmission of audio and video, differences in the perception of noise in physical versus online environments are likely to cause this challenge.

Collaborative work with mixed face-to-face and online groups represents an additional challenge when there is too much background noise in the classroom, as this makes it difficult for both groups to understand each other. Online-only groups may find it especially difficult to know when to return to the main classroom debate.

Students also noted some differences in their teachers' behaviours towards face-to-face and remote students, and noted that some teachers seemed not to pay as much attention to remote students, leaving them little opportunity to engage with the lesson. Students found different strategies to attract the attention of their teachers without necessarily interrupting the whole lesson – such as writing to colleagues on external messaging services – and some would welcome the opportunity to message

teachers directly. The latter was, however, not welcomed by teachers in the study, who felt like this would add an additional burden to their teaching.

The higher need for self-regulation (Rasheed et al., 2020) and lower levels of engagement (Raes et al., 2020b) have further been identified as challenges in the online component of blended learning. Quizzes have been found to increase the engagement levels of online students in blended learning settings (Raes et al., 2020b).

Recommendations for blended learning environments

Technology
Raes et al. (2020a) suggest that technology assistants should be present in all synchronous blended learning environments so that teachers can concentrate on teaching while technology operators can sort out any technological issues that arise during the lesson. This recommendation is likely difficult to implement in a school setting but draws attention to the complexities of blended learning, highlighting that additional support is required to put it in place.

Raes et al. (2020a) also argue for both teachers and students to receive training in the technology that is to be used prior to the start of any synchronous learning so that questions or issues are addressed before rather than during any learning sequence, avoiding unnecessary interruptions. They suggest that this training should include recommendations for students to use headsets rather than built-in microphones and speakers, to ensure that they use a stable internet connection, check the lighting and microphone settings.

Bower et al.'s (2015) case study looking at seven university contexts in which blended learning was implemented, found that audio contributions allowed students to be more responsive in real time and contribute more extensively, which also created a stronger feeling of co-presence. Text chat, on the other hand, was more reliable and allowed for more simultaneous and non-interfering contributions from distance students. Both options bring inherent challenges for students with different SEND, which will be discussed in more detail in section six of this report.

It is important for students to have the right permission to operate the necessary technology; too many privileges and they can inadvertently disrupt the lesson, too few and they won't be able to actively participate (Bower et al., 2015). This shows again how important it is to allow the necessary time for schools and their IT teams to set up blended learning.

Asking all distance learning students to log on 10 minutes prior to the official start of the lesson can allow teachers and IT technicians to troubleshoot any technological problems they may be facing, ensuring a smooth start to the lesson. It may be impractical and even unnecessary to implement such tech checks at the start of every lesson in school but using registration in the morning and the start of lessons after longer breaks to ensure that all equipment is working properly, may avoid unnecessary disruptions during lessons. Furthermore, logging into an online learning platform as a student gives the teacher an opportunity to experience a lesson from a student's perspective. By doing so, they can check that all activities are working and that students can access all materials they will need for the lesson (Bower et al., 2015).

Wang et al. (2018) further suggest that at least two microphones and two cameras are needed to create effective synchronous blended learning environments in which face-to-face as well as distance students feel part of the learning community. One of the cameras and microphones should be used for the teacher whilst the others are used for the students in class.

Clear communication
According to the studies reviewed by Raes et al. (2020a), it is important to have a clear vision of rules and expectations in synchronous blended learning environments. Students need to know what they are expected to do, and should be provided with alternative tasks to complete, such as worksheets, in case they lose their connection.

Teachers also need to be informed about the expectations of the blended learning sessions and the potential challenges that they may encounter and how to address these.

Pedagogical recommendations
Finally, Raes et al. (2020a) list some pedagogical recommendations for synchronous blended learning. These correspond largely to the research on effective distance learning that was discussed above. They firstly suggest that students need to be activated through quizzes and polls, as this will particularly allow students in distance learning to feel part of the lesson. Frequent and strategic questioning of the whole group and individual students is also mentioned as an important factor in increasing student engagement in blended learning. Bower et al. (2015) found that presenting in an animated and humorous manner helped with student engagement, as did strategies that are usually found to be effective in face-to-face classrooms: checking for understanding; providing clear explanations; sensitively responding to students' questions; tightly structuring learning activities and establishing a positive learning environment.

A few additional recommendations can be found in Bower et al.'s (2015) study. The first set relates to the reduction of extraneous cognitive load by clearly formulating instructions and avoiding distractions. They suggest uploading instructions on where to access learning content prior to lessons and to clearly communicate which communication channel and material (i.e. chat or white board) to focus on, so that students know exactly where to look.

A second set of recommendations put forward by Bower et al. (2015) relates to student engagement. They include teachers circulating between face-to-face and online groups to ensure that both student groups are engaged and making use of collaborative learning opportunities. However, online-only groups may find it difficult to know when to 'return' to the classroom if not closely monitored, and background noise may impede conversations in mixed groups.

Based on their comparative case study, Bower et al. (2015) provide a synchronous blended learning design framework. While this is based on research from university settings, some principles are likely to also apply to schools who may want to put blended learning in place. Bower et al. (2015) outline that teachers in blended learning environments should plan their lessons on three levels: pedagogy, technology and logistics and consider the design, implementation and outcome of their teaching. Pedagogical considerations include the clear definition of outcomes, designing for active learning, encouraging regular student contributions, distributing attention between remote and face-to-face students and enhancing a sense of community through co-presence. Technological considerations include the need to match technologies to lesson requirements, setting up technology in advance, becoming familiar with the necessary technology and ensuring that students have all necessary permissions. Finally, logistical considerations include soliciting the necessary institutional support, starting lessons in advance to allow for technological checks or testing the student view of platforms.

02

Motivation and engagement during distance learning

The positive relationship between school attendance and student outcomes is well-documented (see Gottfried, 2010). The ongoing COVID-19 crisis comes with inherent challenges for attendance, which include a lack of access to the internet and devices or additional caring responsibilities. However, this section does not focus on engagement as measured by students being present during distance learning but rather on students' active involvement and motivation.

Keeping students motivated and engaged when learning from home is a key challenge of distance learning. Distraction and reduced focus were cited as the most commonly mentioned negative aspects of emergency online teaching in a study conducted in the United Arab Emirates during COVID-19 (Hussein et al., 2020). Recent data from the UK shows that students in Years 10 and 11 experienced the greatest challenges with motivation for learning throughout 2020 (ImpactEd 2021). Motivation is considered one of the most important aspects of learning in any environment (Miltiadou and Svenye, 2003), as motivational processes can affect both how well children use their existing skills and knowledge and how well they acquire new learning (Dweck, 1986). As such, motivation in relation to education has been extensively researched.

Student motivation in distance learning

Students' perceptions of their ability to complete tasks, and their perceived levels of responsibility for their performance (i.e. self-efficacy), play an important role in cognitive theories of motivation. One construct in this area is often referred to as 'competence' – the extent to which a student feels they are skilled and knowledgeable enough to complete a learning task well. Children's competence, or ability beliefs have been shown to strongly predict both performance and motivation (Wigfield et al., 2014).

While some research suggests that self-efficacy – the belief that one can achieve desired results – declines with age, there is evidence that interventions can increase self-efficacy and improve performance. At all ages, self-efficacy is a strong predictor of effort, self-regulation and persistence (Wigfield et al., 2014).

In brief, research suggests that when students perceive that they are competent, and that they have control over their performance outcomes, they are more likely to be motivated, and to succeed. Individuals with higher levels of self-efficacy have been shown to work harder and persist for longer in the face of difficulties (Schunk, 1991; Bandura, 1993). This raises important issues for the content and design of distance learning. In terms of competence – how can learning activities be pitched appropriately so that they provide an appropriate level of challenge, whilst enabling students to feel confident that they have the ability to complete the tasks set? This may involve providing scaffolds and supportive resources, as detailed earlier in this report, as well as focusing on activities which consolidate and build on prior knowledge, rather than moving on to completely new material. In terms of self-efficacy – how can distance learning environments equip students with the skills and attitudes required to build self-belief in their abilities to meet goals and complete learning activities independently? This is likely to relate to metacognition and the cultivation of self-regulation – also detailed previously in section two – and can be encouraged by fostering mastery experiences which support the development of self-efficacy.

Teachers need to consider students' competence and self-efficacy not only in relation to the learning content of their lessons, but also regarding the technology or resources that they are using to engage in distance learning. Some students may feel competent in their subject knowledge for a lesson but less competent in using online learning platforms or video conferencing software. Similarly, students who do not have access to the internet or devices required to access online learning, or who do not have an environment at home where they can focus on their learning, are likely to struggle with maintaining high levels of self-efficacy. A study of motivation in online distance education suggests that a lack of self-efficacy might impact the likelihood of students' interacting with their teachers and peers online (Miltiadou and Svenye, 2003). Therefore, instructors should identify students who lack the confidence or ability in using technology – possibly through the use of a self-efficacy questionnaire – and provide early support and feedback. The paper suggests setting up a technology orientation meeting, wherein students can be taught how to use the platforms and software. In the case of younger students, it may be parents who need this support, as it could be that low levels of parental self-efficacy, relating to technology, are having a knock-on effect on student engagement and motivation. Our own research (Müller and Goldenberg, 2020b) has shown that teachers and schools who have been working very closely with parents during this crisis perceive this closer collaboration as helpful. But it is unclear whether or not technological support features as part of these closer parent/school relationships. The fact that teachers are not necessarily trained to use distance learning technology, alongside a lack of time, may also impede the facilitation of such training.

A further aspect of motivation relates to students' reasons for engaging in learning tasks. According to theories of 'goal orientation' (Dweck, 1986), students may either be 'mastery/learning-goal-oriented' – engaging in learning in order to improve themselves, gain knowledge and master skills; or 'performance-goal-oriented' – engaging in the learning task because they want to achieve a particular grade or positive evaluation for the outcome of their learning. Some research suggests that learning-goal-oriented students may be more likely to seek challenges, ask for help when needed and be more intrinsically motivated. Whereas performance-goal-oriented students are more likely to avoid challenging tasks and lack persistence, primarily because they want to avoid the negative judgment of others (Dweck, 1986; Miltiadou and Svenye, 2003).

Of course, these goal orientations are not fixed categories and students can display both orientations. A student may be learning-goal-oriented for some subjects and more performance-goal-oriented for others, for example. A particular risk in the current pandemic situation is that, while arrangements for exams and assessment are still unclear in some countries, performance-goal-oriented students may find it particularly hard to motivate themselves if thus far they were primarily driven by trying to achieve a specific grade in an exam. The challenge of the teacher is to draw attention to the purpose of learning beyond test results, and to encourage students to focus on learning for its own sake, rather than performance goals; to think about how the learning they are doing now will equip them well for the future and strengthen

their knowledge and skills regardless of how it will be assessed or the grades they may receive. Educators can encourage learning-goal-oriented behaviour by reinforcing the idea that mistakes are part of learning, by encouraging students to master individual tasks and by focusing on the learning process rather than the end product.

A survey of high school students (Yates et al., 2020) suggests that older students in Years 12 and 13 valued agency over their studies when distance learning during the COVID-19 pandemic; in particular, the autonomy to choose when they spend time studying and how long to spend on various tasks and subjects. In fact, although 90 per cent of students preferred learning in school compared with learning at home, in the future they would still like to maintain some of the flexibility and autonomy that home learning offered – perhaps spending four days in school and the fifth day learning independently from home.

Autonomy is a key driver for intrinsic motivation according to Deci and Ryan's 'Self-determination theory' (Deci and Ryan, 2012). According to this framework, students will be more motivated to learn if they feel a sense of independence and control over their own learning. Distance learning provides a unique opportunity to enable students greater flexibility and autonomy in their education. Studies have shown that, while more directed and controlled learning environments result in better rote learning, this learning deteriorates more quickly over time than the learning that takes place in a more self-directed and autonomous environment (Grolnick and Ryan, 1987). Furthermore, more autonomous learning may lead to greater interest and conceptual understanding (Grolnick and Ryan, 1987).

However, not all students cope well with making their own decisions about scheduling and time management. Yates et al. (2020) have reported that some students feel they have had too much freedom and have struggled without the routines of school, such as a designated start time in the morning, bell times for lessons and specified breaks. It is important to note that whilst autonomy can be motivating, the self-regulation required to manage autonomous learning is something that takes time to cultivate (Zaccoletti et al., 2020). Thirty-nine per cent of high school students in the study by Yates et al. (2020) cited motivation as the hardest part of learning from home. Many parents seem to agree, with a lack of learner motivation being a key theme in a qualitative study exploring parental experiences of remote education during COVID-19 (Garbe et al., 2020). In this study, 55 per cent of parents who cited issues with their children's motivation felt that this problem was specifically due to distance learning arrangements. Some believed that this was related to missing the social learning that happens in face-to-face lessons, whilst others felt that modified grading systems and a lack of incentives from school made it harder for their children to feel motivated.

Another study (Zaccoletti et al., 2020) has conducted a cross-country comparison, looking at parents' perceptions of student academic motivation during lockdown. The study interviewed parents in both Italy and Portugal, finding that in both countries, motivation had decreased as a result of lockdown, though this was more pronounced in Italy. The study's authors hypothesise that this decline in motivation could be linked to a lack of participation in extracurricular activities, which have been shown in the past to have positive effects on academic motivation. They therefore advocate for teachers to promote student participation in extracurricular activities, some of which may be able to take place online during a full lockdown, or within social distancing guidelines when fewer restrictions are in place.

Some suggest that students, particularly younger children, will benefit from rewards for distance learning (Cavanaugh et al., 2004). However, the effects of extrinsic rewards have been extensively debated. Research shows that extrinsic rewards can be detrimental to learning because they can make pupils inherently less motivated to complete learning activities when rewards are no longer available (Deci et al., 1999; Deci 1972; Greene and Lepper, 1974), and may be particularly ineffective for lower achieving students (Fryer, 2011). However, extrinsic rewards may also be useful for cajoling students who are not intrinsically motivated, to complete distance learning activities. Rewards can be very motivating in the short term, particularly for some students, such as those with ADHD who have been found to be more sensitive to both tangible and social rewards (Kohls et al., 2009).

In a distance learning context, rewards may take the form of virtual/e-rewards such as team/individual points given for completing tasks, e-badges and electronic certificates which are already incorporated into some learning platforms and software. A reward could also be sharing examples of excellent work, perhaps in a virtual recognition display. Giving leadership roles to students and informing parents about good work or attitudes to learning are also forms of reward. There are also possibilities of more tangible rewards such as virtual trips and outings, themed days or extra meeting/activity time to complete a fun activity. These rewards may be individual or class/group based but caution should be taken when rewarding aspects of learning which are outside of a student's control; for example, an art activity may be difficult for a student to complete to a high standard if they do not have access to the required materials. Therefore, in some circumstances rewards may be more appropriately based on effort and resourcefulness rather than how closely the finished product resembles the specification. Focusing on these aspects of the learning process also ties in with mindset theory and goal-oriented, rather than performance-oriented, learning (Dweck, 1986).

Another factor that is thought to affect motivation in learning is a student's opinion of, and relationship with the teacher. Research has shown that students display higher effort and more persistence for teachers whom they feel they have a positive relationship with (Montalvo and Mansfield, 2007). Such teachers tend to be those who students consider to be helpful, provide confidence-building feedback, respect and trust students and ensure that workload is manageable for students. These teachers are perceived to be warm, caring and supportive (Montalvo and Mansfield, 2007). Given that during the current pandemic, many students may be taught online by an adult who is not their usual teacher in school, consideration may need to be given to how students can build trust and positive relationships with less familiar members of teaching staff. Although the causal link between a student's relationship with a teacher, motivation and academic achievement is unclear, it does appear that investing time in building a supportive distance learning community impacts positively on student motivation and success.

Student engagement in distance learning

Finally, a further variable which might influence the success of distance learning is how engaged students are. 'Student engagement' is a term which some have criticised for being vague and problematic to define (Ashwin and McVitty, 2015). However, in this case 'engagement' is used to describe the extent to which students show interest and attention in their learning activities and the quality and quantity of their participation. Student engagement has been shown to relate positively to academic performance, student satisfaction and persistence (Meyer, 2014) and in a distance learning environment, it has also been found to reduce the sense of isolation and enhance motivation (Bolliger and Martin, 2018).

According to many theories of engagement, interaction is key. This can involve learner-learner interaction as detailed earlier in this report, collaborative learning as well as learner-instructor interaction and learner-content interaction (Bolliger and Martin, 2018). In a study of online university students, over 90 per cent of participants thought that icebreaker and collaborative activities were important or very important as engagement activities. In terms of learner-instructor engagement, they also highly rated regular announcements and email reminders, discussion forums, using student names and posting grading rubrics. In supporting engagement between the learner and the learning material, the most highly rated strategies were structured discussions, realistic scenarios, content provided in a range of media formats and allowing time to reflect on course elements (Bolliger and Martin, 2018).

Prompt and helpful feedback has also been cited as an enabler for student engagement in distance education (Yates et al., 2014). The research evidence in support of feedback having a positive effect on distance learning outcomes is discussed in more detail in section two of this report. Problem solving, self-reflection and self-assessment are also strategies that have been shown to support online engagement during flipped learning (Wang, 2017).

03

Mental health and wellbeing during distance learning

The impact of COVID-19 on students' mental health

The potential impact of school closures on children's mental health and wellbeing was described extensively in our recent literature review (Müller and Goldenberg, 2020a). We described how disruptive events such as natural disasters or the loss of loved ones, as well as the loss of school routines and structures can affect children's mental health.

Children and adolescents are amidst critical periods of development which make it especially important to protect and promote their mental wellbeing (de Miranda, 2020). The potential effects of the COVID-19 pandemic on children and young people's mental health cannot be underestimated. There are multiple factors which threaten their emotional wellbeing including drastic changes to children's daily routines, reduced physical exercise and time outdoors, reduced opportunities for play and social contact and possibly greater exposure to various types of abuse (de Miranda, 2020; Müller and Goldenberg 2020a). In addition, there are a myriad of wider societal and family issues which have a knock-on effect on childrens' mental health such as increased financial problems, housing issues, family stress and uncertainty as well as restrictions in accessing usual support systems including their religious community and various support groups.

Of course, not all children will have had their wellbeing negatively affected and some groups have been found to be more affected than others (de Miranda, 2020; Guessoum et al., 2020; ImpactEd, 2021). A recent longitudinal study in the UK with 62,254 pupils aged 6-18 showed that average levels of wellbeing were actually relatively stable during the first period of lockdown; however, some groups were negatively affected. In this study these included students from disadvantaged backgrounds, students in key stage 4 and girls, with the latter having higher levels of anxiety than boys when schools reopened (ImpactEd 2021). Others have noted that adolescents with a psychiatric history are particularly at risk for mental health issues during COVID and that adolescent girls and those living in disadvantaged families may also be more at risk than some other groups (Guessoum et al., 2020).

As well as the pandemic itself, a number of other factors related to the COVID-19 pandemic may also be affecting the mental health and wellbeing of people of all ages,

including young people. For example, the COVID-19 pandemic has seen a surge in gaming and social media use. While it has been speculated that individuals may have increased the amount of time they spend gaming online during the pandemic as a coping strategy to alleviate psychological distress, it poses risks to a minority of others (King et al., 2020; Fazeli et al., 2020). Compulsive use of social media has previously been linked to a range of physical and mental health risks, particularly for adolescents, including negative effects on sleep quality, self-esteem and wellbeing (Singh et al., 2020). In some cases, increased social media use has also facilitated the spread of misinformation about the pandemic, increasing panic and irrational behaviour, which can negatively impact on mental health (Singh et al., 2020). However, these extreme levels of gaming and social media use are likely to only affect a small minority of students.

Increased screen time in general also continues to raise concerns and debates about its effect on mental health and wellbeing. Research has highlighted the potential negative effects of excessive screen time on young people, including associations with higher rates of obesity or depressive symptoms (Stiglic and Viner 2019). Those from socio-economically disadvantaged families may also be disproportionately affected by increased screen time and reduced 'green time' (contact with nature) (Oswald et al., 2020). Some research also suggests that the additional screen time and telecommunication that is inevitably part of online learning, can further add to stress and burnout (Mheidly et al., 2020).

It is feared that during the COVID-19 pandemic, long periods of isolation and limited face-to-face social contact, combined with increased screen time, have the potential to create unhealthy lifestyle patterns which may prove difficult to break once the pandemic is over (King et al., 2020).

However, technology is not necessarily only a negative influence on wellbeing. Goldschmidt (2020) discusses how technology can mitigate some negative mental health effects as it allows children and their parents to stay in touch with support communities such as their teachers and support services but also their faith communities. Social media platforms have also enabled students to maintain social contact with their wider family and peers, and have provided ways for local communities to support one another (Marston et al., 2020). Even gaming, when not used excessively, has been found to have educational, physical and therapeutic benefits (Amin et al., 2020) and can enrich people's lives through socialisation, stress reduction and reducing loneliness (King et al., 2020). Key to healthy screen-use is the exercising of self-regulation and a balance of other activities which also promote mental and physical health.

Given the significant mental health challenges associated with the pandemic, and with school closures, it is vital that distance learning strives to support the mental wellbeing of students. Excessive stress can lead to changes in the brain which can ultimately affect memory and learning. Such stress-related changes in the brain can occur after only one week of stress but begin to reverse once stress subsides (Arnsten, 2009). Research suggests that this reversal is supported through environmental enrichment such as positive, supportive learning environments (Arnsten, 2009).

Supporting student wellbeing in distance learning environments

It has been acknowledged that for effective learning to take place, student wellbeing must be addressed (CESE, 2020); and this is just as true in distance learning contexts as it is in face-to-face teaching. This section outlines some approaches that have been found to be effective in supporting students' wellbeing in a distance learning context but it is important to consider students' individual needs and preferences, as only 22 per cent of students in a recent UK-based study wanted dedicated wellbeing time upon their return to school while 56 per cent thought that having less pressure to catch up with their learning would be helpful (ImpactEd, 2021).

Multiple sources have identified the importance of checking in regularly with students, continuing to provide wellbeing support, and connecting students and families with wider services as needed (Reimers and Schleicher, 2020; Müller and Goldenberg, 2020a; WHO, 2020). As studies have highlighted the risks of students feeling isolated and disengaged during remote learning (Mbukusa et al., 2017; Croft et al., 2015),

enabling students to feel emotionally supported has been a key priority for educators during the pandemic (Müller and Goldenberg 2020b). Listening to students and engaging in open dialogue, particularly with disadvantaged students who are facing multiple challenges, is thought to be key to the 'pedagogy of care' that Bozkhurt et al. (2020b) describe. They explain how supporting these students involves understanding their individual contexts and experiences, and ensuring that distance learning arrangements empower rather than reinforce inequalities. This may involve flexibility regarding course requirements, communication and points of contact. They also advocate creating informal social spaces online where students can interact socially. Encouraging peer-to-peer interaction during distance learning is a key strategy for helping students to feel connected and engaged, and this is discussed in more detail in section 2 of this report.

In an article discussing examples of what have been identified as successful online charter schools in America – albeit based on limited evidence – it was noted that personal connections were key (Doyle, 2019). In these case-study schools, it was reported that they recognised the importance of frequent and intentional opportunities for students to interact with caring adults and in one example, the school provided an advisor for each student who connected with them weekly for pastoral support, acting as the key contact for students and their families. In describing another school it was noted that 'leadership believed from the beginning that technology, though critical to online learning, takes a backseat to positive human interactions.' (Doyle, 2019, p. 21)

Government guidance from the DfE has advised that as many aspects of school life as possible should be maintained during distance learning – assemblies and staff briefings, for example – and that there should be frequent contact between pupils and teachers (DfE, 2020d). However, maintaining this high level of support for students and families has placed particular strain on teachers and school leaders (Müller and Goldenberg, 2020b).

It is important to draw from existing research, effective practices that have been successful in supporting mental wellbeing, and to consider whether these could be applied to the current distance learning situation.

A study of online mindfulness courses suggests that these are effective in reducing stress and show similar results to face-to-face courses (Krusche et al., 2012). This finding is supported by a meta-analysis of 15 randomised controlled trials on online mindfulness interventions, which reported significant small to moderate effects on mental health (Spijkerman et al., 2016). Incorporating mindfulness into an online learning program has been tried before. A study looking at the effects of integrating mindfulness exercises in virtual learning environments indicates that they can reduce stress levels for online students (Coxon et al., 2019). However, all of these mindfulness studies were conducted with adults. It is therefore unclear whether incorporating mindfulness activities would support the mental wellbeing of children and adolescents in the same way, and there have been critiques of mindfulness in school contexts. This could be an important area for future research.

A wide range of research suggests that spending time outdoors in nature has mental health benefits for adults and children alike. Nature contact has been associated with decreased anxiety (Bratman et al., 2015), reduced life stress (Wells and Evans, 2003), self-esteem, confidence and resilience (Roberts et al., 2019). In addition, recent research suggests that increased 'green time' may act as a buffer against the negative effects of too much screen time (Oswald et al., 2020). Aside from these benefits, it has also been demonstrated that children are often more active in natural green spaces (Goldenberg, 2020) and that increased physical activity also has a positive impact on mental wellbeing. Therefore, encouraging and enabling time outdoors in nature may effectively support the mental health of young people during distance learning. Parents of younger children can be encouraged to visit local natural sites such as parks and forests, given suggested outdoor activities to engage in if they have access to a garden at home, or encouraged to take daily walks outside in natural places. Older students may need adequate breaks between scheduled live lessons to enable them to access local nature during daylight hours.

Encouraging physical exercise during times of school closures is a popular way of supporting students' mental wellbeing. Physical activity has been shown to have

effects on mental health in children as young as five years old (Tubic and Dordic, 2013). Where sedentary screen time is associated with poorer mental health (Biddle and Asare, 2011), improvements in fitness have been shown to have positive effects on anxiety, depression, mood and self-esteem, and also appear to be associated with higher academic performance (Ortega et al., 2008). Unsurprisingly, research conducted in China suggests that during the pandemic, children substantially increased their screen time, both for learning and for leisure, and simultaneously decreased the amount of time spent doing physical activity – from 540 minutes per week before the pandemic, to 105 minutes per week during the pandemic (Xiang et al., 2020); so encouraging physical activity seems particularly important.

However, it is important to consider that some countries have much stricter lockdown measures in place than those in England. These measures restrict the range in which people can move, or the length of time they can be outside; for example, during the strictest lockdown rules in France, movement is restricted to a radius of 1km for a maximum of one hour per day. Parents' work schedules may also make it challenging for them to take children to green spaces, and some may fear for their children's safety when letting them play outside by themselves due to high levels of traffic, violence or other factors (Blum-Ross and Livingstone, 2018). This can severely limit children's and young people's opportunities to reach green spaces, and to get adequate levels of outdoor exercise. Consoles and apps that encourage children to be physically active can provide a good alternative or addition to sport outside (cf. Blum-Ross and Livingstone, 2018; Hassinger-Das et al., 2020).

A review of research literature based on supporting wellness in online education for adults suggests that strategies such as supporting learners to increase their physical activity, and providing resources on work/life balance, time management, stress and diet, can support the wellness of remote learners, and that personal counselling is the most frequently recommended wellness resource (Thompson, 2014). Peer-to-peer wellness support via social networking tools has also been found to be effective. However, this review also acknowledges that there is no single model for virtual classroom wellness, and that support should be based on the specific needs and characteristics of the student population.

As younger children are likely to have little control over their diet and access to physical activity, some types of support may be more effectively aimed at parents and carers. However, while institutions specifically experienced in running online courses may have the resources and capacity to develop wellness programmes and resource portals to support their students, it must be acknowledged that schools are unlikely to have the same ability to do so during emergency remote teaching. For this reason it is important to not only consider wider research on wellbeing but also to explore research that looks specifically at wellbeing strategies implemented during the COVID-19 pandemic, as well as other comparable disaster situations. However, as yet, this research is scarce.

Mheidly et al. (2020) explore some of the potential impacts of prolonged exposure to digital devices and how this may increase stress and anxiety. They assert that, as the pandemic has shifted communication in both workplaces and schools from face-to-face to online, we should be aware of how this increased telecommunication may impact on both mental and physical wellbeing. The paper advocates for public awareness regarding the psychological repercussions of telecommunication, and makes several recommendations which may be of interest to educators, including:

- increase the frequency of breaks between online classes to release eye strain and prevent loss of interest and attention
- increase students' awareness of the physical and emotional consequences of increased time online, particularly regarding excessive social media use and online gaming
- introduce podcast-based communication and learning as a substitute to visual online encounters (note issues for hearing impaired students with this approach)
- implement healthy practices such as breathing exercises and meditation between online sessions, or as a break during extended sessions
- provide students with opportunities to share feelings and mental struggles.

04

Distance learning in the Early Years

Age-related differences during the COVID-19 pandemic across the world

A report by UNESCO, UNICEF and the World Bank (2020) asked policymakers to indicate the type of support that was provided to students at a national level during the first COVID-19-related school closures.

When analysed globally, the type of medium employed to support distance learning during COVID-19 does not appear to differ between age groups (UNESCO, UNICEF and World Bank, 2020). Overall, online learning platforms were used most widely across all ages, followed by television, paper-based work packs and finally, radio. The data also suggests that the least support overall was available for children at pre-primary age.

However, when analysed per region, the data shows some interesting age-related differences. In Europe, online learning was most common for all age groups, starting at pre-primary level but, for example, in Oceania paper-based work packs were the most common approach to distance learning for the youngest students and online learning was not used at all with this age group. Paper-based work packs were indeed a common form of support for pre-primary school children across multiple regions. They were nearly on par with online learning in Eastern and Southeastern Asia and the second most commonly used medium in Latin America and the Caribbean for pre-primary school children. Television was the most common form of support for pre-primary school children in Sub-Saharan Africa as well as Central and Southern Asia but less commonly used in Oceania or Eastern and Southeastern Asia. Radio was not used at all to support pre-primary school children in Northern Africa or Western Asia.

At primary level, online learning was provided across all regions but paper-based workpacks remained the most popular medium for distance learning in Oceania and the second most commonly used medium in Latin America and the Caribbean as well as Eastern and Southeastern Asia. Television was most commonly used to support

primary school aged children in Central and Southern Asia while radio became the most commonly used form of distance education for primary school children in Sub-Saharan Africa.

It was only at lower secondary level that online learning became the most commonly used medium in the majority of regions, although television remained the most widely spread medium in Sub-Saharan Africa, Central and Southern Asia and was on par with online learning in Northern Africa. Paper-based resources remained the second most popular medium for distance learning in this age group in Oceania, Latin America and the Caribbean as well as Eastern and Southeastern Asia.

These findings suggest that many countries did not consider online learning to be the most appropriate approach for pre-primary school-aged children as it only emerged as the most common form of distance learning in older students.

Given the different approaches that countries have adopted to distance learning for younger children, alongside looking at how they may engage in online learning, it seems important to consider what we know from research about the ability of young children to learn from television and the effect that prolonged screen exposure can have on them. Furthermore, given that some countries have opted for solutions that rely on children's ability to work relatively independently, such as workpacks, it is important to consider what we know about children's ability to learn independently.

Distance learning in the Early Years during COVID-19 school closures

While the results outlined above provide interesting insights into the distance learning provision that countries developed in response to school closures, responses were collected from policymakers rather than teachers, so they do not reflect the many initiatives that were put in place by schools and teachers and how they impacted the learning of young children. This section therefore discusses some of the emerging evidence and examples of approaches to learning in the Early Years during COVID-19. When reading through this section, it is important to consider that these are emerging findings and two of the presented papers are case studies of individual settings or children. Even though the findings may not be generalisable, their insights are valuable in beginning to understand some of the specificities of distance learning in younger children during this crisis.

In one case study from Croatia (Somolanji Tokić and Vukašinović, 2020), a preschool setting in Croatia used a virtual social network to interact with parents while their setting was closed. The private Facebook group had been set up earlier to share children's learning with their parents in an attempt to make learning visible and encourage educational continuity. During COVID-19 kindergarten closures, the group was repurposed to support communication about children's learning in the other direction – from parents to the teacher. Based on parental submissions, the teacher could then prepare some adequate stimuli (e.g. around the concept of time as children felt that time was passing slowly). So even though the main aim of the group was not to share pedagogical resources, it provided the teacher and parents with a way to communicate about children's learning and for the teacher to support children from a distance. Since documentation about children's learning was shared prior to school closures, the teacher also had the opportunity to refer back to children's prior learning, supporting their development.

Teachers and parents in this case study also used video calls to keep students connected and engaged. This allowed those students who were starting primary school in autumn to see their friends before they moved on to another school and enabled students to play their musical instruments to each other (Somolanji Tokić and Vukašinović, 2020).

However, the authors also note that keeping all students and their parents engaged and connected was challenging. Having parents as the gatekeepers to the social platform also meant that teachers relied on them to remain connected to children, which did not work in all cases. Despite its difficulties, this example shows the level of creativity with which teachers tried to ensure educational continuity for their students during lockdown.

Another case-comparison study compared one synchronous and one asynchronous teaching programme in early years contexts in the US (Hu and Lu, 2020). The researchers used observations to study the involvement in distance learning of two children who were aged three to five years old.

In the asynchronous condition the child was engaging in maths, science, literacy and art teaching through worksheets, videos, games via an educational app, physical games and crafts. Parents had to be involved for troubleshooting, preparing materials, dealing with negative emotions, correcting mistakes and uploading their work. The child's completion rate was highest for videos, worksheets and games on SeeSaw (a classroom learning app) and slightly lower for crafts and physical games. The child was least distracted when watching videos, followed by worksheets, SeeSaw games and crafts and finally physical games during which the child was distracted at each observation. Finally, the child's emotions were more positive for videos, worksheets and SeeSaw games and more negative for crafts and physical activity. The authors explain the child's more negative emotions towards crafts and physical activity with the level of parental involvement. These activities required the child to wait for their parents rather than engaging in self-directed learning, which could lead to frustration. The low distraction rate and positive emotions during videos correspond to suggestions by Fedina et al. (2017) concerning the potential benefits of distance learning for younger children.

The child in the synchronous learning condition engaged in reading, writing, maths, science, social studies, integrated arts, PE/health, Spanish and library and computer science in a mixture of live lessons and 'unplugged' time for independent learning. The teacher used quick sharing in a group, one-on-one question and answer exchange, one-on-one exchange with a teacher in a separate virtual room and one-on-one discussions with students. The authors found that teacher and peer presence improved the child's level of engagement and required less parental involvement.

The findings indicate that the asynchronous approach allowed for more independent learning but the synchronous condition allowed for higher levels of engagement. A mix of both therefore appears to be most suitable.

Finally, a study on children's distance learning in the Early Years with 6,702 parents from Hong Kong (Lau and Lee, 2020) sheds further light on distance learning in younger children. In Hong Kong, schools were suspended for all children apart from the children of key workers in January 2020 and all students apart from those in the first two years of kindergarten returned to school for a short period in May, after which the summer holidays were moved forward in an attempt to curb rising COVID-19 cases. Schools were not required to provide distance learning but many did so anyway – 94.2 per cent of kindergartens and 98.8 per cent of primary schools provided some sort of distance learning, with 72.7 per cent of kindergartens and 83.3 per cent of primary schools providing online activities. in the study. The survey was administered three weeks after the start of the first school closures.

The difficulty most noted by parents was children's lack of focus/interest, which was noted by 73.9 per cent of kindergarteners' parents and 70.7 per cent of primary school students' parents. The bulk of online learning children in this study participated in was asynchronous (74.1 per cent kindergarten and 66.3 per cent primary). Self-directed learning was noted as an issue, as only 9.1 per cent of children in kindergarten and 14 per cent of primary school students completed online learning without parental assistance.

The majority of parents whose children did not engage in online learning were satisfied with the school's offer, but around 80 per cent hoped that schools would offer online learning with a particular focus on pre-recorded materials by teachers and small-group live instruction. At the same time, parents were worried about their children's screen time (75.7 per cent). Finally, parents noted a lack of variation in activities – and in the case of parents of primary school students, too much work. Some parents also highlighted a lack of communication with the school, but it needs to be borne in mind that the study was carried out at the very start of the pandemic, so teachers and families are likely not to have settled into new routines yet.

A survey with 3,275 parents of pre-school children in Henan Province in China during the COVID-19 outbreak (Dong et al., 2020) revealed that 92.7 per cent of children were involved in online learning. Eighty-four point six per cent reported that the online learning lasted for less than half an hour each time. Nearly half of children watched recorded lessons and about one-third were involved in live teaching and interacted with an instructor at least once a day. Only a minority of parents believed that online learning had better learning outcomes (11 per cent) and is more efficient (12.6 per cent) than face-to-face teaching, while about half of responding parents expressed a neutral position about the potential benefits of online learning. The qualitative data indicated that children were lacking a 'learning atmosphere' (i.e. contact with teachers and peers) and that a lack of self-regulation meant that parents had to be present during online learning sessions to support their children's learning.

An increased need for adult supervision and contact in younger children was also noted by Cavanaugh et al. (2004). This meta-analysis of the effects of distance learning on four- to 16-year-olds notes that younger students will need 'more supervision, fewer and simpler instructions, and a more extensive reinforcement system than older students' (p. 7). Therefore, it recommends that distance learning programmes for young children involve regular teacher contact with students and parents, shorter lessons and rewards for learning.

Dong et al. (2020) also found some interesting subject-related differences in parental perceptions of distance learning. A greater number of parents were positive about the potential benefits of online learning for science learning; 37.6 per cent thought that online learning could support children's science learning, 25.2 per cent thought it could support their literacy development, 21.1 per cent their learning in the arts, and 24.8 per cent felt it could support development of social skills – particularly interesting given parental concerns about the lack of social contact with peers. Fewer parents were positive about the potential of online learning for the development of independent skills (17.8 per cent), and only 10.9 per cent believed it could support the development of physical health. Concerns about children's vision and sedentary interaction with screens were mentioned as concerns relating to children's physical development in the context of online learning (Dong et al. 2020).

Despite certain concerns, the majority of parents appreciated that online learning kept their children occupied during the COVID-19 outbreak (60 per cent) and just under half (47.6 per cent) felt that it had improved parent-child relationships and inspired their educational ideas (47.8 per cent,) but concerns included the difficulty of combining young children's distance learning and working from home due to children's limited capacity for self-directed learning.

Taken together, these findings show that even though online learning was not the main form of distance learning in the Early Years during the COVID-19 outbreak, it was part of the offer in some countries and schools. The results indicate that a close collaboration between schools and parents was beneficial to children's distance learning, that independent learning was difficult at this age group but that increased parental supervision could lead to negative or frustrating learning experiences. Furthermore, the increased parental supervision needed at this age group also makes it particularly difficult to support distance learning while having to work from home. Some subjects and skills also appear to lend themselves more to online learning than others but this evidence is still limited and will require further exploration in follow-up studies. Synchronous learning allows students to stay connected to their peers and largely seems to require less supervision from parents, but a mix of synchronous and asynchronous teaching seems to be most effective in meeting children's and parents' needs.

Digital media use in young children

As outlined above, many parents are concerned about their young children's screen time during this pandemic (Lau and Lee, 2020) and the potential impact of screen time on children was discussed in section four.

Historically, debates around the use of technology and the internet by young children

have been dominated by strong opposition and concerns about its impact on children's development as well as an urge to regulate their technology use (Livingstone et al., 2017). Debates about the right amount of 'screen time' largely dominated the discourse, worrying parents and educators alike (Blum-Ross and Livingstone, 2018). More recently, the debate appears to have moved on to a place where it is largely accepted that digital technologies are very much part of children's 'multimodal lifeworlds' (Arnott and Yelland, 2020) from a very young age onward.

Indeed, the most recent data collected by Ofcom (2020), which is based on parent report from 2019 – before COVID-19 – shows that 98 per cent of three- to seven-year-olds in the UK watch television on any device. More of this is now on-demand than live television. Meanwhile, fifty-one per cent of three- to four-year-olds and 64 per cent of five- to seven-year-olds now watch videos on YouTube. Nearly half of two- to four-year-olds and 63 per cent of five- to seven-year-olds use tablets to go online and 39 per cent of three- to four-year-olds and 62 per cent of five- to seven-year-olds play digital games, with 17 per cent and 35 per cent respectively playing them online. Tablet use by three- to four-year-olds has increased significantly by about 20 per cent since 2015, according to these latest results (Ofcom, 2020).

As parent report can be an unreliable and imprecise indicator of children's media use, a research team from the US developed an app to objectively measure children's screen time of 346 three- to four-year-olds. They found that one-third of their participants owned their own devices and spent an average of two hours a day on these devices (Radesky et al., 2020). It was more difficult to assess the precise time for participants who were sharing devices and it is possible, of course, that children who own their own mobile devices spend more time on them than their peers who have to share with siblings or parents.

This data indicates the important position of mobile devices such as tablets and mobile phones in young children's lives. Even in 2016, Palaiologou (2016) found that over 60 per cent of children under the age of three across England, Luxembourg, Greece and Malta regularly accessed digital media, with a preference for television (86 per cent) over computer or Internet-based technologies (23 per cent). Sixty-five per cent of parents in this study reported that they used tablets for educational purposes with their children (e.g. to read or develop literacy or numeracy skills). From age three, an increasing proportion of children started to interact with computer- (68 per cent) and internet-based activities (54 per cent), indicating that the shift of interest away from television and toward internet-based media may happen earlier than suggested in previous studies which observed this shift occurring around the age of eight (Gutnick et al., 2011).

This shows that digital media are indeed very much part of young children's lives, even below the age of three, and that their interest in internet-based media appears to emerge at a younger age than previously anticipated. Given this and the current context in particular it is therefore important to consider debates about screen time and its potential effect on children's development, which will be discussed in the following section.

Debates around screen time in young children

Blum-Ross and Livingstone (2018) show that parents can feel guilty or stressed when they feel that they allow their children 'too much' screen time. Their study with families in London showed that many parents still refer to the '2x2 rule' of screen time (no screen time under two and no more than two hours for older children) that was part of screen time guidance published by the American Association of Pediatrics in 1999 (cited in Blum-Ross and Livingstone, 2018), despite the fact that these have since been updated (Council on Communications and Media, 2016) to reflect more recent societal changes and new research insights. These updated guidelines make the following recommendations:

- no screens for infants and toddlers apart from video chats
- educational television with accompanying parents from 15 months (more about that below)

- restricting screen time to one hour for two- to five-year-olds
- the development of media plans for families that outline restrictions
- involving children aged six and above in the development of these plans
- parents paying attention to their own screen time so that they model good behaviour to their children.

Hassinger-Das et al.'s review (2020) outlines that the displacement hypothesis lies at the origin of concerns about potential negative impacts of screen time on young children's development. This is the idea that more time spent in front of the television would lead to less time spent on other activities such as homework, sports or reading, which in turn would lead to negative outcomes for children's cognitive and physical development, such as lower academic performance or weight gain. However, the link between exposure to television and behavioural outcomes appears to be more complex. Some studies have indeed found that extensive exposure to non-educational television can negatively impact students' cognitive performance, behavioural and health outcomes (Cox et al., 2012; Lin et al., 2015; Schmidt et al., 2009; Stiglic and Viner, 2019; Tomopoulous et al., 2007, 2010; Walsh et al., 2020) while other research has observed a positive impact of certain forms of screen time.

For example, studies have found a positive impact of educational television such as Sesame Street or Blue's Clues on children's learning and their socio-emotional development (e.g. Anderson, 2000; Kearney and Levine, 2019; Mares and Pan, 2013; Richards and Calvert, 2017) as well as their language development (Madigan et al., 2020; Neuman et al., 2018). A recent study has found similar benefits of an educational app on children's vocabulary development (Dore et al., 2019). The positive impact of co-viewing or co-interacting with media on children's (language) development has also been found in numerous studies (Madigan et al., 2020; Myers et al., 2017; Samudra, 2019). Madigan et al. (2020) found that the quantity of screen use was negatively associated with children's language skills, but exposure to educational programmes and co-viewing were associated with stronger language skills. A recent meta-analysis has also shown a positive impact of educational apps on children's academic development, in particular their mathematics learning (Griffith et al., 2020). Taken together, this suggests a more complex relationship between screen time and developmental outcomes.

Some researchers therefore argue that a focus on time spent in front of screens alone is too simplistic and does not take the full complexity of the relationship or families' lived experiences into account (Blum-Ross and Livingstone, 2018; Palaiologou, 2016). They therefore suggest focusing on the quality rather than merely the quantity of screen time (e.g. Blum-Ross and Livingstone 2018; Hassinger-Das et al., 2020; Palaiologou, 2016). Blum-Ross and Livingstone (2018) also argue that a focus on time alone does not take into account the full range of activities that children can engage with via screens and digital media. For example, equating screen time with not moving does not take a wide range of activities into account that combine movement and/or being outdoors and screen time (e.g. Pokemon Go).

The most recent WHO guidelines appear to take this into account. While they still suggest no screen time for infants and no more than one hour for children up to the age of four (WHO, 2019), the guidelines speak of 'sedentary' screen time, suggesting that active screen time that encourages children to move would not be counted towards this quantitative recommendation.

Based on research from the science of learning, Hirsh-Pasek et al. (2015) outline four pillars of educational apps: **active, engaged, meaningful** and **socially interactive** and discuss how they relate to research on media use in young children. These are the criteria that apps have to fulfil in order to be considered 'educational'.

1. Active

Hirsh-Pasek et al. (2015) outline that children need to be active participants in their learning if it is to be effective. This does not relate to physical activity but rather the

mental state of being 'switched on' and thinking actively.

Television and videos
Hassinger-Das et al. (2020) suggest that children benefit from actively watching television and videos, but they do not learn from passively watching videos. Children who interact with characters on television, repeat words, sing along or engage in thinking tasks show higher understanding of the taught content. Furthermore, interactive media can also help children to transfer knowledge from abstract objects on screens to real life, which young children have difficulty with when watching non-interactive videos due to the substantial cognitive resources this task demands (Kirkorian, 2018). This is because videos lack social cues such as shared gaze or calling children's names. When videos contain such social cues (e.g. during a video chat with a known person), then toddlers show higher transfer abilities, which are lost when a recorded video using such cues is not responsive to children's behaviour (Kirkorian, 2018).

E-books and apps
E-books can provide a range of additional features such as animated pictures, music or videos that can engage learners, help young children's word learning and aid their understanding. Furthermore, e-books can be designed to foster interactions between caregivers and children, which can also enhance learning (Hassinger-Das et al., 2020). Shared reading and co-viewing , a process which can involve a range of activities, such as asking children open-ended questions, using 'wh' prompts (who, what, when where) or sentence completion are associated with improved language skills (Noble et al., 2019; Madigan et al., 2020). E-books can also give children control over their reading based on their developmental stage, which improves their involvement and learning (Hassinger-Das et al., 2020; Hirsh Pasek et al., 2015).

Overall, these studies suggest that active and interactive use of media, whether it is television or e-books and apps, can help young children's learning. Watching videos or television passively, on the other hand, seems to have little effect on their learning. This has important implications for distance learning planning. As outlined above, some countries have chosen to provide distance learning via television, which research suggests can have a positive impact on children's learning as long as it is engaging and interactive. In contrast, if television shows do not require active engagement from children (e.g. a documentary) they are less likely to have a positive impact on children's learning. Finally, too much exposure to mainly entertaining television programmes and apps may have negative impacts on children's cognitive, language and physical development.

2. Engaged

The second pillar described by Hirsh-Pasek et al. (2015) relates to young children's engagement in their digital learning. As is well-known from the educational research literature, children learn better when they are interested and engaged in their learning (Lei et al., 2018).

Television and videos
Interactive television programmes that correspond to children's developmental stage and are neither too easy nor too difficult are most likely to keep young children engaged. Furthermore, multiple repetitions of the same content during the same or multiple episodes can help children to transfer knowledge across contexts.

Television programmes that are left on in the background, on the other hand, are likely to distract children from their play and decrease interactions with their caregivers. Extensive exposure to adult television shows can even negatively impact children's executive function development (Lillard et al., 2015).

E-books and apps
As outlined above, e-books can contain very helpful features that can support young children's reading comprehension. These features can also increase children's engagement in the reading process (Hassinger-Das et al., 2020). However, if additional features distract children from the main storyline, they may do more harm than good.

Reich and colleagues (2016) compared shared reading with e-books and traditional books and found that the former can benefit children if features support word learning or engage children in thinking that is related to the story (e.g. 'wh' questions or sentence completion). If, however, the additional questions are unrelated to the main storyline (e.g. asking children to find words that start with a specific letter), they can impede comprehension. Reich et al. (2016) also found that caregivers' comments during shared reading are more likely to focus on features and functionalities of the platform (e.g. 'press here') than during shared reading of traditional books.

Adult support also seems to play an important role in e-book reading for young children. Young children who have engaged in shared reading with an adult have been found to become more independent e-book readers. Furthermore, children have been found to be more engaged in the reading process if they are provided with immediate feedback, such as when answering a question relating to the text they are reading (Hassinger-Das et al., 2020).

Finally, Hassinger-Das and colleagues (2020) suggest that programmes and applications which foster long-term engagement, for example those that allow children to work on a building project for a longer period of time, can increase engagement, especially if they allow children to develop their project according to their own interests.

In sum, engagement is as important in online learning as it is during face-to face learning and it can be fostered through programmes and applications that take children's current level of development into account and provide helpful but not distracting features.

3. Meaningful

Much like in face-to-face learning, it is important that new learning through digital technologies is connected to students' previous knowledge to help embed it and enhance storage in long-term memory, ultimately facilitating its retrieval and use across contexts.

Television
Some research has found that co-viewing of videos and television shows with an adult and engaging in a dialogic process can help children in a similar way to co-reading, while others suggest that similar benefits cannot be observed for shared viewing (Hassinger-Das et al., 2020). Samudra et al. (2019) found that it is only auditory, not audiovisual word learning that was enhanced during co-viewing and argue that this is likely due to the fact that this was the mode co-viewers used to communicate with the young children.

As noted by Kirkorian (2018), young children find it difficult to transfer knowledge from the screen to real life but it has been found that familiarity with characters on the screen (e.g. if children watch the same programme regularly) or having a character from a programme as a toy and acting out some of the action while watching the programme can help children to make these connections. Providing information about characters in a programme prior to their first appearance can also help create this feeling of familiarity as can the repetition of episodes, so children become familiar with its format and can then apply learning to other contexts (Hassinger-Das et al., 2020).

E-books and apps
Again, quite like in face-to-face learning and as outlined above for television, repetitions can help children's learning when engaging with new apps or e-books. By repeating the use of crucial features of a new app, children become familiar with them, freeing up cognitive load before they move on to new learning content. Just like when reading traditional books, caregivers and teachers can help connect stories in e-books to children's previous lived experiences, which helps their learning (Hassinger-Das et al., 2020). While apps may not be able to relate specifically to children's lived experiences, they can ask children to connect story content to their own environment (e.g. objects in their room or on the screen). The use of such co-reading features in apps can also improve caregivers' competence in co-reading as it can help them

to find areas to draw their children's attention to and expand on certain topics (Hassinger-Das et al., 2020).

Overall, this brief overview suggests that children can learn from television, e-books and apps if the content is connected to their lived experiences and context. Caregivers can individualise e-book reading experiences by relating content to children's personal lives while apps can connect learning to children's surroundings. Repetition is also important to familiarise children with characters in apps, programmes or books and having tangible toys that correspond to television programmes they see on screen can help them to transfer learning.

4. Socially interactive

The final pillar presented by Hirsh-Pasek et al. (2015) relates to reciprocal social interaction. Starting from birth, children take social cues from their environment, sharing their gaze, repeating actions and gestures that others show to them and taking turns even before they are able to fully articulate their words. Rather than merely the number of words children hear, it is the interaction with their caregivers', the extensiveness of their caregivers' responses and their turn-taking behaviour that predicts children's language development.

Television and video
The lack of these social interactions in videos is the reason why younger children below the age of 2.5 are generally unable to learn from videos (Whitebread et al., 2005; Hassinger-Das et al., 2020). Linguistic research has shown that children who hear two languages in real life learn to discriminate between sounds in the two different languages while those that only hear the two languages over video do not, which has also been confirmed for vocabulary learning (Kuhl et al., 2003; Krcmar et al., 2007; Roseberry et al., 2009). However, more recent research focusing on interactive video conversations have shown that such video-mediated interactions can indeed support children's learning (Roseberry et al., 2014; Myers et al., 2016)

E-books and apps
The research reviewed by Hassinger-Das et al. (2020) appears to suggest that the reaction of others to one's own actions (known as social contingency) makes a bigger difference to children's learning than the medium these exchanges occur in. A study comparing shared book reading in a live condition, via video chat and a pre-recorded condition found that learning outcomes were comparable across the live and the video chat condition but not the pre-recorded condition. Similarly, another study found that children's individual use of a geography app led to worse learning outcomes than a physical lesson but when a lesson was taught via the app these differences disappeared. Some studies have found that individual e-book reading can lead to a weaker emotional response than shared reading with an adult (Hassinger-Das et al., 2020).

The presence of another child in real life while learning from an app can also enhance children's learning, suggesting that social presence makes a difference and children can learn equally well through video and face-to-face interactions but learn best when engaging in reciprocal social interaction. (Hassinger-Das et al., 2020).

This overview of research on learning with media in young children highlights the importance of social interaction for children's learning and development. It was shown that medium is less important than social interaction, suggesting that distance learning via video conferencing could be an option, even for young children, and that children from the age of three upward may be able to learn successfully from interactive videos.

Recommendations for distance learning with younger children

When planning distance learning for younger children, the following points should be taken into account:

- Student engagement needs to be balanced with required levels of parental supervision. Videos, worksheets and apps appear to require the lowest level of parental supervision, crafts and physical activities the highest , and asynchronous learning seems to allow for more independent learning whilst synchronous learning appears is associated with higher levels of student engagement.

- Technology can be used to ensure educational continuity for children by communicating closely with parents about their children's learning and providing opportunities for students to engage with each other.

- The potential negative impact of prolonged sedentary screen time for young children needs to be considered and ensured that activities on screens are active, engaged, meaningful and socially interactive.

05

Distance learning for children with special educational needs and disabilities (SEND)

Inclusion of all learners is a moral imperative and the basis to achieve a fairer and more equitable society (UNESCO, 2020). As such, it is paramount that the needs of students with SEND are taken into account at all times, including in online and distance learning settings.

According to the latest DfE (2019) statistics, 15.4 per cent of students have special educational needs. This number combines students with a statement or Education, Health and Care (EHC) plan (3.3 per cent) and those who receive SEN support in school (12.1 per cent). The most prevalent kinds of SEN were speech, language and communication needs, with 24 per cent of students having this recorded as their primary need. This was followed by moderate learning difficulties (21 per cent) and social, emotional and mental health (19 per cent). Among students with EHCs, the most common need was autism spectrum disorder (ASD), with 30 per cent of students with EHCs having ASD as their primary need. This section looks at how children with some of these needs can best be supported in a distance learning environment. We have attempted to cover a wide range of needs but the list is not exhaustive and throughout this section it is important to bear in mind that SEND varies vastly and that even children with the same diagnosis are likely to have individual strengths, weaknesses and preferences that should be considered when planning distance learning. First we will discuss whether distance learning can represent a viable alternative for students with SEND more generally.

Distance learning for children with SEND

As outlined in the introduction to this report, distance learning can take many different forms and does not necessarily have to involve online learning. Sensory work packs and serendipitous learning (e.g. by helping around the house, daily exercise or experiencing snow) can represent important learning opportunities and should be taken into account when planning distance learning. However, this section will mainly focus on online learning.

Even outside of the current pandemic context, data from US online schools shows that distance education can provide a welcome alternative for some children with

SEND who might be struggling in mainstream settings. A study by Thompson et al. (2012) found that the proportion of students with SEND was substantially higher in US online schools (24.6 per cent) than the general population (around 15 per cent), which suggests that parents and students themselves may see them as viable alternatives to a physical school environment that might be less suitable to cater to their children's needs. Insights from special school teachers in our own research (Müller and Goldenberg, 2020) corroborate these findings as they highlight that some children with SEND benefitted from an online learning environment during the COVID-19 outbreak as it allowed them to pace their learning according to their needs, without additional distractions from a physical environment.

However, online learning also brings inherent challenges, such as social isolation, higher levels of self-directed learning or an overload of information if it is not carefully planned, all of which can be particularly challenging for children with SEND. It is therefore important to disentangle the potential benefits that an online learning environment can offer for some children with SEND from the factors that can make the online learning experience more challenging and discuss how best to plan distance learning so that it is most effective for all students, including those with SEND. This section first discusses what we know from the scarce existing research on distance learning for children with SEND (and where this research is not available, adult learners with SEND) before moving on to presenting findings about distance learning during the COVID-19 outbreak in special schools and with children in mainstream settings who have special educational needs. Finally, we present some case studies that discuss how some of the challenges described in the literature were addressed in specific settings.

Challenges of distance learning for students with SEND during COVID-19

A recent report by the Centre for Applied Education Research (2020) based on a survey of schools in the Bradford region of the UK shows that access to distance learning was an even bigger issue for children with SEND than the general school population. While respondents estimated that almost half of their students were not engaging in distance learning during the national school closures in 2020, this number rose to two-thirds for vulnerable students and those with SEND. Respondents emphasised that the lack of routine and the need to self-organise and self-motivate were particularly challenging for students with learning difficulties. The report further highlighted that a lack of access to external services such as speech and language therapy and being unable to sit close to children to support them with their work presented additional difficulties and put children with SEND at a disadvantage during school closures.

Toseeb et al.'s (2020) study with parents of children with SEND during the COVID-19 crisis provides further insights about the needs of children with SEND during this time. They found that parents of children with SEND needed specialist support, for example, from their children's special educational needs coordinator, to reassure them, provide advice about their child's needs or to help establish a new routine. Furthermore, parents sought advice on how best to support their children's wellbeing and highlighted the need for educational resources that are appropriate for their children's needs. Parents further highlighted how important it was for their children to see familiar faces and for parents to get a break from caring duties. Parents also emphasised the need for structured activities outside the home and more practical help such as support with food shopping. Finally, parents highlighted the need for support with home learning and resources to explain the situation to their children, as well as the importance of specialist support.

As Toseeb et al. (2020) argue in their paper, many of these needs, such as support with home schooling, are likely to also be issues for parents of all children but are likely to be exacerbated in the context of SEND. However, some more specific needs, such as the need to reestablish routines, are more specific to some children with SEND, in particular students with ASD, for example, whose parents formed the majority of respondents to Toseeb et al.'s survey. The need for familiar teachers to deliver online teaching may potentially also be greater in the context of children with SEND.

Given the additional challenges in distance learning for some children with SEND,

it is important to explore the potential negative impact on their mental health and wellbeing, which was the aim of Asbury et al. (2020). Looking at the same cohort as Toseeb et al. (2020), they asked parents to assess their children's mental states during lockdown and distance learning. Participants talked about their children's worry for themselves (i.e. their own health), and others (e.g. grandparents' health) as well as generally heightened levels of worry. In some cases, this worry led to children adopting previously unencountered behaviours, such as wanting to sleep in environments that made them feel more secure, or engaging in obsessive washing or disinfecting of their hands.

The loss of specialist support, routines and support networks also impacted negatively on the mental health and wellbeing of children with SEND during the pandemic, according to Asbury et al. (2020). In some cases, the loss of these support structures led to parents losing their jobs as they could no longer rely on specialist after-school activities for their children which allowed them to attend full-time work. Parents also highlighted the difficulty of explaining to their children with SEND why they had suddenly been deprived of all their usual activities, which added additional tension to family relationships. However, parents felt that when their children's school provided additional support to explain the situation to their children, this information alleviated their children's stress and helped them to cope with the situation much better.

The study also highlighted that some students with SEND were struggling with their emotions during this time. Some parents reported that their children were feeling depressed, while others reported that their children were acting out more frequently or more extremely as a result of school closures and a loss of routines.

Potential benefits of online/distance learning for students with SEND
Asbury et al. (2020) found that a substantial minority of parents of children with SEND noted positive aspects of COVID-19-related school closures. These tended to be parents whose children found the school environment challenging and who benefited from the calmness of their own home. However, the majority of parents expressed negative feelings relating to the school closures, which were described above.

Outside of the current context, Marteney and Bernardowski (2016) studied teachers' views on the potential benefits of online instruction for students with SEND. Their study focused on primary and secondary teachers in asynchronous, self-paced online learning environments in the USA. The sample included 80 teachers of students aged five to 20 years of age.

Results suggested that online education can have substantial benefits for students with a range of disabilities in terms of improving access to learning. Sixty-nine per cent of teachers felt that online education improved access for students with visual limitations, 83 per cent said that it improved access for students with auditory limitations and 92 per cent indicated that it improved access for students with physical limitations. The study argues that the possibilities provided by technology may allow students with SEND to become more independent learners.

The majority of teachers in this study also noted a decrease in bullying and cyber-bullying in online settings. However, 40 per cent of respondents had not and the authors note that it may be particularly challenging for teachers in online settings to notice instances of bullying unless they are directly reported to them by students. It is also important to consider that these results rely on reports of teachers working in online schools, rather than objective measurements.

Academic outcomes
As outlined above, in the USA it appears that online education is chosen by or for a higher proportion of students with SEND than those without, possibly in the hope that it can respond better to students' needs than its mainstream equivalents. However, the results of research looking at students' academic outcomes in such settings is very limited and results are mixed. The evidence is also partly based on teacher report rather than objective measures of student outcomes, making ultimate conclusions problematic and requiring further studies.

Thompson et al. (2012) found that children with SEND in their study had significantly worse academic outcomes in online settings when compared to their grades in traditional settings. In contrast, the teachers in Marteney and Bernardowski's (2016) study reported improved academic performance of their students (72 per cent), particularly relating to the asynchronous learning environment, which 86 per cent judged as having a positive impact on students' academic outcomes.

In other words, online learning appears to be a viable alternative to face-to-face teaching but cannot be assumed to bring automatic improved outcomes for children with SEND. While it can provide improved access to students with a range of SEND, may be more adaptable to their schedules and more flexible in catering to their specific needs, it may also come with the need for higher levels of parental support, which needs to be taken into account when designing online learning. Thompson et al. (2012) also note that many online courses are not built with accessibility standards in mind. Therefore, while they would theoretically have the potential to cater better to students with SEND, their design needs to be adapted to these students' needs in order for them to fully benefit from the advantages of online learning.

Supporting students with SEND in an online environment

Designing learning content for students with SEND should consider that what constitutes good design for this group, is generally good design for all (Cooper 2006). While specific needs may require the use of particular technology (e.g. screen readers, captions, specific colours or fonts), general principles of good design apply to all students.

This is why the importance of focusing on the pedagogy and the learning content that we want to make accessible for students with SEND rather than (or as well as) the technology that should be used to do so has been stressed in the literature (Cooper 2006; Seale and Cooper 2010; Kelly et al., 2004). They argue that often the focus is on how to make particular elements of a software or website accessible when the focus should be on making the learning accessible. This is why it is important to have clearly established learning objectives and reflect on the barriers that students with SEND may face in reaching those objectives and how these barriers can be addressed.

As part of this process, teachers should consider if a learning objective can best be achieved by presenting the same content in a different way to students with particular learning needs (e.g. by using a textual or audio description of a graph to improve its accessibility) or if a different yet educationally equivalent activity may be more appropriate. Cooper (2006) provides the example of different programming languages. If one language is accessible while another one is not and the goal is for students to learn about the process of programming, the accessible language can be chosen. If, however, the objective is for them to learn a specific programming language, an alternative solution needs to be sought.

The approaches that have been taken by Oak National Academy in the UK in terms of accessibility features on the platform may provide a useful example of some of the things that need to be considered. Their features include:

- closed captions for all videos
- British Sign Language interpreted English and Maths lessons for students in years one to three
- considerations to colour palette, contrasts and font sizes
- ARIA (Accessibility Rich Internet Applications) hints throughout the website to support navigation
- visual support and Makaton signs in specialist lessons
- availability of transcripts for all lessons.

As well as the platform having these accessibility features included as standard, there are 600 specialist resources for students with SEND available. Repetto et al. (2010) also

outline five wider factors that can support students with SEND in an online learning environment. They suggest that it is important to create links between the curriculum students study and the outside world, such as the workforce or higher education; to create a safe and positive learning environment; to support students with SEND to develop metacognitive strategies so they can take more control of their learning and to develop positive relationships in the learning community. Note how these strategies correspond largely to what has been discussed in previous sections on effective distance learning and supporting student engagement and motivation.

The focus on supporting positive relationships in the learning community relates to findings by Toseeb et al. (2020), which are described in detail below, and which highlight the importance of familiar teachers for some students with SEND. This is further supported by findings from Asbury et al. (2020), who highlight the additional stress caused by an unfamiliar situation for children with SEND. Given that a change to distance learning is already an unfamiliar situation for all children, but one that may be particularly stressful for those children who require clear routines, an additional change in teacher might make it difficult for them to concentrate on their learning. This may have implications for how national initiatives such as Oak National Academy or BBC Bitesize in the UK are utilised; they are likely to be most effective when integrated as part of a wider offer with familiar teachers.

Given the wide range of learning materials and children's specific needs, it is difficult to give a blanket recommendation of how best to adapt learning materials to meet the specific needs of students, but the focus on the learning objective rather than the accessibility technology is a first step, together with a focus on developing positive working relationships, creating links between the curriculum and the outside world and focusing on the development of metacognitive strategies.

Distance learning for students with ASD

As with all kinds of SEND, the effects of ASD vary vastly between individuals in both nature and severity. However, they often include social communication difficulties, a need for routines, and the exhibiting of intense interests and activities (APA, n.d.). These will need to be considered in the context of COVID-19 and distance learning.

The impact of COVID-19 on students with ASD
Children with ASD are likely to have been particularly negatively affected by the ongoing pandemic (Asbury et al., 2020; Toseeb et al., 2020; Amorim et al., 2020; Mutluer et al., 2020). This section discusses some of the additional challenges that children with ASD have faced as a result of this crisis.

Behaviour
A small-scale survey of parents by Amorim et al. (2020) found significant differences in the level of children's behavioural changes reported by parents of children with ASD compared to parents of children without ASD. Parents of children with ASD noted a rise in anxiety (41.7 per cent), irritability (16.7 per cent), hostility (5.6 per cent) and impulsivity (2.8 per cent). Difficulties with emotion management were also noted by the majority of parents of children with ASD (55.8 per cent) but only a minority of parents (28.6 per cent) of children without ASD.

This is supported by findings in Mutluer et al. (2020) whose study with parents of 87 individuals with ASD (15 girls and 72 boys, aged three to 29) found that many reported a rise in their children's aggressive behaviour (55 per cent), existing or new tics (26 per cent), a deterioration of communication skills (29 per cent) as well as changes in sleep (44 per cent) and appetite (33 per cent).

The impact of new routines
Levels of anxiety were reported as significantly lower and levels of adaptability to the new situation significantly higher in children with ASD who maintained routines than those with ASD who did not (Amorim et al., 2020). Social isolation, changes to routines, a lack of time outside, boredom and remote learning were mentioned as the main challenges by parents. Interestingly, no significant differences in the impact on learning were reported by parents of children with ASD and those without.

Glumbić and Đorđević (2020) recommend putting a particular focus on re-establishing routines for children with ASD during this ongoing pandemic. They advise the use of social stories that explain to children and young people what is going on and what they are expected to do. Teachers and parents should allow for sufficient time for children to ask questions and process the information and how it affects them. Glumbić and Đorđević note that children with ASD may be overwhelmed with the new information and, as a result, ask the same questions or related questions repeatedly. They recommend setting some ground rules such as specific times during the day at which children can ask these questions and setting limits to the amount of time that will be spent on answering these. Furthermore, they suggest children with ASD should be given the freedom to incorporate the pandemic into their play, though exposure to content displaying catastrophic scenarios should be restricted or avoided.

Supporting students with ASD during COVID-19
Yarımkaya and Esentürk (2020) note that physical activity has been found to have a positive impact on aggressive behaviour, stress levels and behavioural problems in children with ASD outside the current pandemic and emphasise the importance of continuing to encourage children with ASD to stay physically active. Examples of beneficial activities described by the authors include stretching, meditation or breathing exercises, as well as the use of workout videos. The authors also note that it is important to take children's preferences and needs into account to ensure that activities are motivating and enjoyable.

It may take additional time to incorporate new routines, such as more regular and different handwashing, and time needs to be made to teach children with ASD these new routines and allow them to get used to them. Adding timers or hour glasses can help students with ASD to better understand for how long they should be washing their hands (Glumbić and Đorđević 2020).

Effectiveness of and approaches to distance learning in students with ASD
Given the social communication difficulties and need for structure and routines associated with ASD, one might hypothesise that students with ASD would benefit from an online learning environment, where lesson structures are predictable and interactions with others often occur in writing, allowing for more time to think about and process others' answers. Adams et al.'s (2019) review and survey study with university students suggests a more complex picture, however. They found that fewer than 40 per cent of students with a diagnosis of ASD chose to undertake online learning, largely because they felt that it would provide them with fewer opportunities for interactions, and fewer than 20 per cent actually thought that they learned more effectively online. The reasons for choosing online over face-to-face instruction largely overlapped with those provided by the general student population in other studies (e.g. flexibility or the availability of a particular course)

When asked more specifically about the online learning environment, students with a diagnosis of ASD identified that they could feel lost and overwhelmed by too many options on their online learning platform but also due to a lack of clarity regarding expectations and deadlines. Adams et al. (2019) argue that clarity should be an underlying principle of any good online learning design, but is even more important for students with ASD who may struggle with anxiety or social communication difficulties, for example, that may hinder their exchange with tutors.

Adams et al. (2019) therefore propose three features that are of particular importance for students with ASD in an online learning environment – curriculum alignment, interaction plans and course site design, which are all explained in more detail below. It is important to note that these features are likely to help all students in accessing and organising their learning but may be particularly important for students with ASD.

Curriculum alignment
This feature relates to making the links between the components of a course and the desired learning outcomes more explicit. Eighty per cent of respondents in Adams et al.'s (2019) survey found it helpful when teachers made the links between content across multiple weeks more explicit and 70 per cent found clarifications from teachers about the online learning content helpful. Thirty-five per cent had

difficulties identifying which aspects of the course were most important. Adams et al. (2019) therefore suggest applying the principles of constructive alignment. Biggs (2014) outlines that constructive alignment consists of determining intentions for what students should learn and how they will demonstrate their knowledge, designing learning activities so they can achieve these goals and designing assessments that will allow students to demonstrate their learning. It appears to be particularly important for students with ASD to make these connections visible and explicit.

Interaction plans
Adams et al.'s (2019) study shows that interaction with teachers and fellow students can improve the learning process for some students with ASD and hinder it for others, which is why it needs to be planned carefully. One barrier noted by respondents to the survey was not being able to see their teachers in discussion forums and not receiving immediate answers to questions while studying. They did, however, appreciate receiving immediate responses through the same channel, so it was not so much the medium itself but rather how it was used that made a difference to their learning experience.

Interaction with other students could also be both a barrier and an enabler to learning. Forty-seven point six per cent of respondents to the survey found interactions with other students helpful while others indicated that they found the interaction with others distracting. Dahlstrom-Hakki et al. (2020) found that students with ASD, learning disorders and ADHD in their study generally preferred synchronous over asynchronous interaction but some welcomed the advantages of asynchronous interaction such as the ability to think longer about one's answer. Distractions from noisy environments or backgrounds were also noted as problematic by participants in Dahlstrom-Hakki et al. (2020). In contrast to students' self-reported higher levels of engagement and comprehension following the synchronous condition, their performance was actually slightly better following asynchronous discussions.

Adams et al. (2019) therefore propose personalised interaction plans for students with ASD as some might benefit more from synchronous discussions while others may prefer asynchronous interactions. Findings from Dahlstrom-Hakki et al. (2020) regarding students' better performance following asynchronous discussions also need to be taken into account during planning as a balance may need to be found between the synchronous condition, which some students may perceive more positively due to increased social presence, and the asynchronous condition, which allows students to reflect longer on their answers and replay contributions from teachers and peers.

Course site design
Finally, Adams et al. (2019) looked in more detail at features of course design that may help students with ASD during online learning. The majority of respondents (66.6 per cent) reported that they preferred for information to be presented in small chunks, which is in line with what we know about learning and the processing of information (e.g. Sweller et al., 2011), and some reported issues with processing the amount of information that was presented on a page and navigating their online learning platform. The study also presented participants with three mock course sites that all contained the same learning content but with different degrees of additional information and distractions (e.g. images and colours). Participants preferred the image with the fewest distractors and least information and some still found it difficult to understand which order to complete the tasks in, which highlights that students with ASD may need additional support in navigating the correct order of tasks. Finally, students in this study noted that they liked the use of video as it allowed them to stop and rewatch content as they found it most helpful.

Distance learning for students with ADHD

ADHD is the one of the most commonly diagnosed neurobehavioural disorders in children and adolescents (Wilens and Spencer, 2010) and features of ADHD, such as inattention, lack of planning and organisational skills and hyperactivity, have been found to have a large effect on academic performance – ADHD is associated with poorer attendance, higher rates of exclusion and lower grades (May et al., 2020).

The impact of COVID-19 on students with ADHD

A report from the European ADHD guidelines group warned that children with neurodevelopmental disorders such as ADHD are 'particularly vulnerable to the distress caused by the pandemic and physical distancing measures, and they might display increased behavioural problems' (Cortese et al., 2020 p. 1). The report recommended that during school closures, teachers should pay particular attention to ADHD students when monitoring student's submission of tasks, their participation in online classes and their general wellbeing 'because of their disorganisation and increased level of risk' (Cortese et al., 2020, p1).

Surveys conducted in China with parents of over 240 children with ADHD suggest that childrens' ADHD behaviours were more severe during the COVID-19 outbreak than they were ordinarily. Symptoms were thought to be affected by both the child and parent's mood state (Zhang et al., 2020). These findings were supported by a study from Japan, which also found that ADHD behaviours, particularly inattentiveness, were worsened during school closures (Sasaki et al., 2020). Research conducted in Australia reports that children (aged five to 17 years) with ADHD had reduced their exercise and outdoor time during the COVID-19 pandemic in May and had increased their screen time (Sciberras et al., 2020) which may also have affected the changes in ADHD behaviours described above, given that time spent outdoors has been associated with reduced symptoms in several studies (Kuo and Faber-Taylor, 2004; Faber-Taylor and Kuo, 2009, 2011) and physical activity is also associated with better cognitive performance in children with ADHD (Hartanto et al., 2016.)

However, qualitative research conducted with 125 young adults with ADHD also suggests that ADHD involves an interaction between individuals and their environment – people with ADHD may experience their ADHD symptoms differently depending on the environment they are in and the tasks they are undertaking (Lasky et al., 2016). Over half of the respondents in Lasky et al.'s longitudinal study described aspects of their ADHD as context specific, finding that some environments amplified their struggles whereas others made them almost non-existent. Therefore, it is to be expected that ADHD symptoms may be affected by the move to distance learning which involves changes in both tasks and environment for most learners.

Potential benefits and challenges of distance learning for students with ADHD

Bearing in mind that inattention, hyperactivity and impulsivity are the three features defining ADHD (APA, 2013) it seems probable that during distance learning, without the direct supervision of a teacher, students with ADHD are likely to struggle with maintaining focus, organising their time and resources and resisting distractions. Existing research suggests that learners with ADHD may have more difficulty in self-regulating the amount of effort they put into their work and are more reliant on instant rewards for motivation (Zentall et al., 2013). Instant feedback and rewards may be more difficult to implement in a distance learning context.

However, it has been argued that there may be potential for engaging students with ADHD using electronic distance learning tools such as live chat/electronic messaging, blogs and interactive resources. One paper theorises that using ICT allows learners with ADHD to productively multitask which is thought to be a key strategy for self stimulating the cerebral cortex. It should be noted that this paper was based on case studies of just 2 students. (Fovet, 2007). However, other studies support the effectiveness of computer-based learning for children with ADHD (Shaw and Lewis, 2005). In one such study, students completed twice as many maths problems on a computerised task as they did on a paper-based task. Rapid computerised tasks which incorporate elements of competition and animation are thought to offer further gains (Zentall et al., 2013).

A study from Iran found that computer-based learning programs may be more effective for children with ADHD when they incorporate a pedagogical agent (a computerised character which guides the learner through activities). The research, which involved 30 boys aged 11 to 12 with an ADHD diagnosis, found that a computer-based maths programme with a pedagogical agent had a significant effect on learning achievement in maths compared to the same maths programme with no pedagogical agent, promoting deeper learning, more engagement and higher levels of interest. This is thought to be because the agent plays a key role in gaining the child's attention

and directing it appropriately to relevant information throughout the activities (Mohammadhasni et al., 2018).

Some researchers (Pelham et al., 2011; Fovet, 2007; Lee et al., 2002) assert that the common intuition that children with ADHD need quiet environments with minimal stimulation in order to concentrate and learn effectively may be incorrect. Some studies suggest that things we may consider as 'distractors' may actually enhance performance on cognitive tasks.

There is some research to suggest that adding sensory stimulation (e.g. added colour, music or animations, or increased requirements for active responding) to a learning task can improve the performance of students with ADHD (Zentall et al., 2013), although the authors do note that some of the research carried out has involved only single participants. For example, overlaying colour onto texts has been found to improve reading accuracy (when reading aloud) and reading comprehension (when reading silently) for ADHD learners compared to their peers (Zentall et al., 2013) and printing addition problems on coloured cards rather than grey cards improved the speed at which they were solved (Lee and Asplen, 2004). Another study found that children with ADHD improved their handwriting when writing on coloured, rather than white paper, indicating better attentional control and motor skills in the presence of increased colour stimulation. This effect was usually not seen in their peers without ADHD (Imhof, 2004).

Computer-based reading programs which incorporate additional auditory and visual stimulation have also been found to enable faster reading and better comprehension for some college students with ADHD (Hecker et al., 2002) and background music was found to improve performance in a maths calculation task for school-aged boys (Abikoff et al., 1996). In some studies, benefits were only observed in students with ADHD, whilst in others the gains from additional sensory stimulation were greater in students with ADHD than in their non-ADHD peers, in some cases even enabling students with ADHD to perform equally well as their peers, eliminating group differences (Zentall et al., 2013). In some other studies, benefits were observed in students with ADHD whilst other students were actually negatively affected; for example, whilst white noise has been found to disrupt performance on a memory task for students without ADHD, it improved cognitive performance for those with it (Soderlund et al., 2007).

Thus, activity design or learning environments which could be criticised for creating extraneous cognitive load for learners without ADHD, may actually be supportive for learners with ADHD. One issue however, is that students with ADHD become habituated to stimuli more rapidly than their peers and thus the effects of additional stimulation may attenuate over time (Zentall et al., 2013). Furthermore, the relationship between increased stimulation and improved learning performance is not a straightforward correlation. Whilst some types of noise such as background music and white noise have been found to improve performance for students with ADHD, other types of noise such as chatter and ambient classroom noise have been found to be detrimental to performance. Similarly, whilst some additional visual stimulation, such as the use of colour, has improved performance, competing visual stimulation such as cartoons playing on a monitor adjacent to the learner (Zentall et al., 2013) or films playing in the classroom (Pelham et al., 2011) have impaired performance. A video distractor in the classroom was found to negatively impact the behaviour and productivity of all children in one study, but those with ADHD were disproportionately affected, showing the greatest decline (Pelham et al., 2011).

There are also likely to be individual differences regarding effects. One experiment found that playing music from the radio during seated classroom work improved the completion rate for learning tasks for 29 per cent of children aged 7-12 with ADHD, yet it had no effect on 61 per cent of participants and was detrimental for the remaining 10 per cent. This mixed pattern of response was replicated in a follow up study (Pelham et al., 2011). It has been suggested that these varying responses to stimulation could reflect differences in underlying arousal. Whilst some children with ADHD may be under aroused, and therefore helped by additional stimulation, for others additional stimulation acts as a distractor (Pelham et al., 2011).

How does this relate to distance learning? As the aforementioned research suggests that additional stimulation can have a significant effect on the learning of children with ADHD, yet this effect may differ between individuals and across tasks, practitioners may wish to encourage parents and students to discuss and explore learning preferences and how these can be supported at home. For example, teachers may discuss with parents that working with background music may be beneficial for some students with ADHD. In addition, as children who are underaroused may unconsciously seek to increase their arousal by using movement (Hartanto et al., 2016) to improve their focus and attention, allowing for such movement during and in between learning activities may support self regulation. Zentall, whose research is cited throughout this section, has created a checklist for teachers and parents advising how to help children with ADHD fulfil their need for both stimulation and competence; this is accessible online (Low, 2019).

Another aspect of distance learning which may support students with ADHD is the constant availability of written instructions and materials uploaded to learning platforms. As students with ADHD often struggle with sustaining attention and holding verbal material in mind (Zentall et al., 2013), retaining sequences of verbal instructions during face-to-face lessons may be challenging. A distance learning context, whereby instructions are written clearly and can be referred back to, may therefore enable ADHD learners to better follow task guidelines.

Despite some potential advantages to distance learning, including potentially having more control over the learning environment, there are still indications that students with ADHD face several challenges in the current context. A study of 648 adult students engaged in distance learning in Israel during the COVID-19 pandemic suggests that those with ADHD report higher levels of loneliness and more negative experiences of distance learning than their peers. College support, support from peers and hopeful/positive thinking mediated these effects, indicating that such emotional support may be particularly important for those with ADHD (Laslo-Roth et al., 2020).

Distance learning for students with dyslexia

Individuals with dyslexia have particular difficulties with the decoding and spelling of words while their reading comprehension is relatively intact (Snowling, 2019; 2020). Given the strong reliance on written words in an online learning environment, it is important to consider how students with dyslexia perceive distance learning and how they can best be supported in such an environment.

Habib et al. (2012) studied the experiences of students with dyslexia in a virtual learning environment and found that their difficulties with online learning included information overload, issues with word processing tools, inadequate search functions and having to deal with more than one system at a time. While this study was carried out in a university setting and findings cannot be applied directly to younger students, some of the findings may inform planning in school contexts.

Reading

One issue noted by participants in Habib et al.'s (2012) study was that they found crowded texts with animated images and texts that spanned over multiple columns difficult to read, but there was no overall agreement among participants regarding their preference for online over print media. Some preferred print because they found it easier to highlight important sections but others did not notice a difference.

Writing

Nearly all participants in Habib et al.'s study noted writing difficulties and some felt that these were exacerbated in the online environment. This was due to two main reasons. Firstly, some participants found it slower to type than to write using pen and paper and the authors argue that this may be due to the different hand-eye coordination that is required for the two tasks. Secondly, some participants found it difficult to make the connection between what they have typed and what they saw on the screen, making it more challenging to recognise the text. In contrast, other participants preferred writing using keyboards and word processing software due to

the spell and grammar checks which allowed them to notice mistakes that they would have missed had they been writing on paper. Some participants also noted that they used assistive technology such as talking word processors which made it easier for them to spot mistakes.

Chat functions were considered relatively difficult to interact with by participants in Habib et al.'s (2012) study. This was due to the speed at which the conversations took place and the time it took them to read and type responses.

Group work
The study suggests that students with dyslexia may be less inclined to engage in group work due to a feeling that they can contribute less to joint written work and a feeling of embarrassment regarding any mistakes they might make. So while collaboration has been found to be an effective strategy in distance learning, particularly to increase student engagement (see above) it needs to be considered that this approach may entail certain difficulties for students with dyslexia and others such as those with ASD or students with visual or hearing impairments. It may thus be beneficial to consider the approach students with different kinds of SEND prefer and offer alternatives that take students' preferences into account.

Online learning platforms
Some respondents noted difficulties with the online learning platform and while this may be linked to the particular system used in the study, it seems important to consider the functionality of platforms and websites that are used and how much reading or searching they require to complete and submit tasks. A transparent filing system where subfolders correspond to the main folders was also mentioned as important by respondents with dyslexia in Habib et al. (2012) as they found it difficult to navigate the filing system and were not always clear when and where new files were added. Given that it generally takes students with dyslexia longer to read and locate information, it can be particularly time-consuming for them to have to go through multiple options until they find the right one when file and platform organisation is not transparent.

Another aspect relating to learning platforms that was raised by respondents in Habib et al. (2012) was consistency. They noted that some of their lecturers used different platforms, which added to the burden of having to navigate through different systems and structures. Furthermore, some platforms in the study were used for academic and social purposes and some respondents noted that this led to an influx in information, making it more challenging to filter which information they should prioritise.

A lack of flexibility regarding deadlines was further perceived as a challenge in the online learning environment. Respondents noted that the online system did not provide the possibility to assign different deadlines to individual students that would take their needs into account, adding additional pressure or requiring to send their assignments separately, outside the learning platform via email or hard copies. Making use of features that allow individual students to submit their work via the same system even though at different time points may avoid singling out students.

Distance learning for children with Developmental Language Disorder (DLD)

DLD is a neurodevelopmental disorder that affects roughly 8 per cent of the student population in the UK (Norbury et al., 2016). Children with DLD have difficulties with their language development in the absence of any other impairments or injuries such as ASD, hearing loss or brain injury. They have variable difficulties with their receptive (listening and reading) and expressive language (speaking and writing) development, which can affect phonology (speech sounds), semantice (vocabulary), grammar, discourse (narratives). These difficulties can negatively affect children's academic achievement (Conti-Ramsden et al., 2018).

While we did not find any studies looking specifically at supporting students with DLD in a distance learning environment, we will briefly outline some aspects of their developmental profile that need to be taken into account when planning online

learning for children with this developmental disorder.

Listening
The phonological processing difficulties of children with DLD are well-documented (e.g. Claessen et al., 2013; Chiat, 2010). It has been suggested that children with DLD process phonological input at a slower rate than their peers (e.g. Alt and Suddarth 2012), which affects their ability to process oral input adequately. In an online environment lags in auditory transmission due to weak internet connections may make it particularly difficult for children with DLD to follow their lessons. Using video rather than audio-only as well as visuals and gestures can support the language processing of students with DLD. Furthermore, using short and simple language can help students to process the information they need to complete their tasks.

Reading
DLD can be associated with reading difficulties and can co-occur with dyslexia (Snowling et al., 2019; 2020). However, the nature of reading difficulties in children with DLD appears to differ from that in dyslexia. While children with dyslexia mainly present with decoding difficulties with relatively mild reading comprehension difficulties, children with DLD tend to have decoding abilities in the normal range but more severe comprehension difficulties. In other words, their reading comprehension difficulties are due to their lower language comprehension overall. They know fewer words on average, which makes it more difficult for them to access text. When DLD and dyslexia co-occur, both decoding and reading comprehension are affected (Snowling et al., 2020). It is important to keep these difficulties in mind given that most online learning environments rely quite heavily on written instructions and stimuli. Using shorter, less complex sentences and language may benefit children with DLD, both in an online and a face-to-face environment.

Literacy
Children with DLD also often display difficulties with spelling (Joye et al., 2018) and writing development (Dockrell et al., 2007; 2009). Joye et al.'s (2018) meta-analysis shows that children with DLD lag significantly far behind their peers in their spelling development and highlights high levels of variation in their performance. The meta-analysis also found that the spelling abilities of children with DLD corresponded to their overall language abilities and that of younger children with similar language abilities. This suggests that children with DLD are significantly more likely to make spelling mistakes in their writing, which should be taken into account during assessment. In an online learning environment, technology such as spell checks and suggested words may help children with DLD to improve their spelling. These features may be particularly useful in contexts where the focus is on the production of longer written texts rather than spelling so students can fully concentrate on the main intended learning outcome.

Given the spelling and reading comprehension difficulties children with DLD have, chat functions that require fast-paced responses may not be the most appropriate feature for students with DLD. Asynchronous forms of text-based interactions that allow students with DLD to re-read what others have said and prepare their responses may be more appropriate than 'live' chat. However, care should still be taken for text-based input to generally remain as complex as necessary but as simple as possible.

Glossaries and hyperlinked word definitions, on the other hand, may be an advantage of online learning platforms that can help students with DLD to improve their text comprehension. For example, easier synonyms and simple language definitions of new terms can help students with DLD to process and access their learning.

Finally, Dockrell et al. (2009) found that children with a history of DLD tend to produce shorter texts with poorer sentence structure and that they have difficulty organising their texts and structuring their ideas. As written work may be prioritised in distance learning contexts, it is important to keep these difficulties for children with DLD in mind. Students with DLD may benefit from additional time spent on teaching writing strategies.

Distance learning for children with Down's syndrome

As with all forms of SEND, the relative strengths and weaknesses that individuals with Down's syndrome display vary but they may often have difficulties with fine and gross motor skills, speech and language development, number skills and verbal short-term memory (Daunhauer et al., 2020; Godfrey and Lee 2018; Malak et al., 2015). Down's syndrome is also associated with a higher risk of hearing loss (Kreicher et al., 2018; Sacks and Wood 2003; Shott et al., 2001; Raut et al., 2011) and poor eyesight so the findings in this section may also need to be considered alongside the following sections.

Delays in the development of cognitive and motor skills can affect how easy children with Down's syndrome find it to use computers and websites that were not designed with their specific needs in mind. Given that the majority of distance learning is currently taking place online, it is important to investigate what challenges children with Down's syndrome face and how they can best be supported.

In a survey study with nearly 600 parents of children with Down's syndrome, Feng and colleagues (2008; 2010) investigated the difficulties children and young people with Down's syndrome face when using computers. Individuals were between 4 and 21 years old with 51 per cent aged 5-10, 17 per cent between 11-13 and 22 per cent aged 14-18 and results are based on answers their parents provided to open questions about their children's difficulties with computer use. Feng et al. (2008) found that 83 per cent of children with Down's syndrome in their study had started to use computers by the age of six and that 80 per cent were using them for education and 95 per cent for entertainment purposes; however despite this early engagement Feng and Lazar (2010) found a number of cognitive, physical, perceptual and societal challenges relating to computer use in children with Down's syndrome.

Cognitive challenges

Language difficulties

A frequent difficulty stated by parents in this study were language difficulties relating to reading or writing. Sixteen point nine per cent of respondents reported reading difficulties and 9.3 per cent mentioned writing or communication issues.

Children with Down's syndrome typically have a number of language difficulties. Their receptive language is usually stronger than their productive language (e.g. Arias-Trejo and Barron-Martinez 2017).

Parents in Feng et al. (2010) reported that their children found it difficult to follow text-based instructions or to understand keywords, often requiring them to sit with their children and take them through tasks step-by-step. Reading difficulties can also make it hard for children with Down's syndrome to navigate the internet to find the information they need or to troubleshoot when problems occur as often they have difficulty understanding error messages. Language difficulties also represented a barrier for children with Down's syndrome to engage with others online, as often alternative communication methods such as sign language or picture exchange communication methods are not available online. Emails or chats were often perceived as too frustrating to be enjoyable for children with Down's syndrome in this study, limiting their possibilities to interact with others in written form. Furthermore, parents noted that their children faced similar difficulties with more complex language online as they did when producing texts offline. This was a particular issue for children aged 14 and above in this study, as the developmental gap between children with Down's syndrome and their peers increases as they grow older.

Arias-Trejo et al. (2020) found an interesting link between sleep quality and language production in children with Down's syndrome. Children with better sleep efficiency produced more oral language in their study. Sleep quality can be affected in children with Down's syndrome even outside of the current context, but the current situation may represent an additional stress factor, potentially influencing children's sleep quality. Given the impact stress can have on sleep (see section on mental health and wellbeing for a detailed discussion), it needs to be considered that oral language may

be affected further in the current circumstances. It may thus be worth discussing h with parents whether their children's sleep has been affected in the current context and considering how this could affect their language abilities.

Navigation
According to findings in Feng et al. (2010) navigation in an online environment poses a major challenge for children with Down's syndrome. They can find it difficult to recognise which links to click on or how to get from one page to another, how to open and close windows, which can lead to them opening too many windows, which in turn can slow down system functioning. Locating files can present an additional challenge as well as viewing email attachments or entering URL addresses.

Troubleshooting
Feng et al. (2010) further found that children with Down's syndrome can find it extremely difficult to troubleshoot or find alternative solutions when things do not follow the routine and path they are used to. While they can learn the steps to get into programmes or applications and use their basic functions, they can find it challenging to circumvent any issues such as a different name or location of a file, an error occurring or an unexpected site or pop-up window opening. Often children will rely on somebody else fixing the issue for them, not least due to a lack of patience (see next point).

Lack of patience
Parents in Feng et al. (2010) further noted that a lack of patience can lead to their children getting frustrated when working with computers and educational software, particularly if it is slow to operate, instructions are too complex and answers are not easily achievable. For example, one parent noted that their child found it difficult to listen to lengthy instructions on how to use a particular software or website, suggesting that tutorials or videos with instructions may not be the most effective support for children with Down's syndrome.

Amount of information
Feng et al. (2010) also found that the amount of information search engines produce can be overwhelming for children with Down's syndrome and that they can find it challenging to think of the right key words to enter into a search engine to get to the desired results. Instructions on educational websites can also be too complex for the reading level of many children with Down's syndrome, making it difficult for them to engage with the content.

Inconsistency in design was another concern that parents raised in relation to their children's use of computers. They suggested that their children could have trouble understanding when the same key had different functions in different programmes.

As Feng et al. (2010) argue, individuals with Down's syndrome are not alone in getting frustrated with websites or software that is not user-friendly but the lower cognitive and linguistic abilities in children with Down's syndrome are likely to make it more challenging for them to resolve any occurring issues, which is why it is important that they are either accompanied by a teaching assistant or another adult during distance learning, or provided with clear, visual instructions on how to operate a system.

General cognitive difficulties
Feng et al. (2010) note that abstract thinking abilities are substantially delayed in children with Down's syndrome, which makes it difficult for them to link abstract concepts in the computer world (e.g. the recycling bin) to concepts in the real world (i.e. deleting an item). However, some parents also thought that a more visual representation of functions could help their children to navigate the computer and the internet more effectively, given the relative strength of visual memory in children with Down's syndrome. This discrepancy suggests that not all icons are automatically intuitive to children with Down's syndrome but that their relatively strong visual memory may help them to learn about their function and use them appropriately.

On a more abstract level, parents also noted that their children with Down's syndrome had trouble understanding the full potential of computers and how they

link to the outside world; they can find it difficult to process that a website can be a representation of something that exists in the real world.

Children's limited memory capacity also means that they require many repetitions before they can complete tasks independently, which means that adequate time needs to be planned in for children to work with teaching assistants and/or their parents at home to master a specific IT routine. However, Feng et al. (2010) also note that particularly older children may want to use the computer independently and can get frustrated if they feel like they are being watched by an accompanying adult. Therefore a right balance needs to be struck between practical explanations and guidance and allowing children to explore a new tool, sit or software on their own but with someone to hand to troubleshoot should need be.

The attention deficit associated with Down's syndrome can make it hard for children to concentrate on a task for a prolonged period of time while the fast pace of many educational apps can make it difficult for them to keep up, leading to frustration. It may hence be a good idea to extend the answer period in tasks, so children have an appropriate amount of time to have a go at responding, thereby limiting the chance of frustration.

Physical challenges

Feng and Lazar (2010) note that children with Down's syndrome can face a number of physical challenges in the use of computers. Smaller hands and shorter fingers can make it harder for them to reach the right keys, while weaker muscle tone can lead to faster fatigue or pain after using computers and impaired fine motor skills can make it difficult to operate a mouse precisely, particularly when needing to click on small icons, but they tend to still be easier to operate than keyboards (Feng et al., 2008).

Many children with Down's syndrome have difficulties using multiple fingers or both hands for typing, so they often revert to using just one index finger which is a slow and error-prone process (Feng et al., 2008; Feng and Lazar 2010; Hu et al., 2013).

Given the difficulty that some children with Down's syndrome have with using the keyboard, it would seem plausible to suggest that students should make use of voice recognition software to aid their text production. However, Hu et al. (2013) actually found that voice recognition was extremely prone to error production in individuals with Down's syndrome. The best performance in their study still showed an error rate of 40 per cent and the remaining productions were almost unreadable. This suggests that the speech difficulties typically associated with Down's syndrome make it difficult to use speech recognition software even though it could be an alternative for individuals with milder speech impairments.

Another piece of assistive technology tested by Hu et al. (2013) was word prediction, the system that allows word processing or email programmes to suggest words based on the first few letters a person types and the context they occur in (e.g. Google Mail, Word). The study showed that individuals with Down's syndrome were able to understand and learn how to use word prediction software but its impact on error rate and typing speed was mixed. While some participants benefited from word predictions, it caused others to slow down or make more errors than during traditional entry. It should be noted that at the time when the study was conducted, word prediction was a lot more complex as it required searching through a list while now words just appear as a grey suggestion which one can either accept by pressing enter or reject by continuing to type. It may be possible that this type of word prediction is more beneficial for individuals with Down's syndrome as some participants in Hu et al.'s (2013) study found the process of searching through a list of words distracting or even stressful.

Finally, Hu et al. (2013) note that despite the challenges with alternative input methods, participants in their study actually thought positively of them, which suggests that they may be a viable alternative as long as students are trained to use them and the technology is advanced enough to be able to accommodate speech errors produced by individuals with Down's syndrome.

Other challenges of online learning for children with Down's syndrome

Software problems
Feng et al. (2010) also investigates some inherent design flaws of educational software for children with Down's syndrome. One main issue are instructions that are too complex and text-heavy for most children with Down's syndrome. Shorter, more visual instructions could help children to access the learning content more easily.

Secondly, the mis-match between children's age and their cognitive abilities can be frustrating for children with Down's syndrome. While they may have to learn basic literacy or numeracy skills as teenagers, content at this level is often geared toward younger children, making it too childish and uninteresting for adolescents to engage with.

Too strong an entertainment element and inaccurate positive feedback (or feedback that is framed positively in reaction to a wrong reply so is not transparent enough) can also confuse children and hinder their learning.

Safeguarding
Feng et al.'s (2010) study also emphasises a crucial risk relating to children with Down's syndrome in online environments. Many parents in their study noted that their children can be too trusting, making them vulnerable in an online environment. Close monitoring is considered as the most effective way to protect children but requires parents' or teachers' time and can be frustrating, particularly for older children who may desire some privacy. An additional risk related to children inadvertently clicking on inappropriate content. Both of these issues certainly also relate to typically developing children but appear to be increased in children with Down's syndrome and need to be considered, both in a home and a school context.

A further risk relates to the limited memory capacity of individuals with Down's syndrome which makes it difficult for them to remember passwords and if they can remember them, the typing difficulties outlined above can make it difficult to enter them accurately (Feng et al., 2010).

Age and computer use
According to Feng et al. (2010) different difficulties appeared to occur more at different ages. For example, older children appeared to struggle more with writing online and navigating the interest while younger children struggled more with using the mouse and troubleshooting.

It needs to be borne in mind that some of these are likely to be an artefact of the tasks they were completing at different ages. For example, younger children may be required less frequently to navigate pages independently, making it harder for parents and teachers to realise if they were struggling with this skill had they been asked. The fact that writing online was considered problematic most commonly by parents of older children may also be a result of more challenging writing tasks they had to complete at that age.

However, the finding that trouble shooting and the use of mice become less problematic with age suggest that children with Down's syndrome are able to develop these skills over time and to become more independent users of the internet as a result.

As mentioned in the introduction to this section, hearing and visual impairments are also frequently associated with Down's syndrome and we will cover strategies that teachers can employ to support children with hearing and visual impairments in distance learning contexts in the following sections. While many of these are likely to help children with Down's syndrome it is important to bear in mind that these children have complex needs that span across their cognitive, motor and sensory abilities, which is why some of the strategies that can be supportive for children and young adults with a single impairment may be less suitable for children with Down's syndrome or require additional supervision (for example, the use of captioning).

Distance learning for students who are deaf or hard of hearing

The online environment can provide some significant advantages over a noisy classroom context when assistive technology is enabled. AbilityNet, a UK charity specialising in assistive technologies, suggests that text services, induction loops and assistance listening devices can help individuals who are deaf or hard of hearing to access online content.

The following adjustments can further support individuals with hearing impairment according to the charity's recommendations:

- changing types of alerts to visual notifications (e.g. screen flashing or vibrations)
- using captions
- connecting hearing aids to devices
- activating phone noise cancellations to lower the volume of background noise.

However, despite this assistive technology, a number of difficulties remain in the online classroom for students who are deaf or hard of hearing.

McKeown and McKeown (2019) identify three barriers to online learning faced by deaf students. These are:

- the learning management system
- course content
- language and communication.

The authors argue that all of these must be addressed so students can fully access online learning.

Barriers to distance learning for students who are deaf or hard of hearing

Learning management systems
Accessibility of the learning management system is generally considered the responsibility of software developers, as it includes the compatibility with screen readers or the possibility to add captions to audio or video content (McKeown and McKeown 2019), but it is good practice to check if a particular piece of software complies with accessibility laws and guidelines before it is purchased or rolled out across a school.

Course content
In contrast, the accessibility of course content should be considered the responsibility of teachers and schools. These include all content that students need to access in order to follow their course; Word documents, powerpoints, videos, etc. Based on previous studies, McKeown and McKeown (2019) suggest that the most common approaches to making content accessible to students who are deaf or hard of hearing include captioning videos, providing PowerPoint slides as PDFs as these are more accessible to screen readers and providing lecture or video transcripts but this might not be sufficient as they do not take potential language difficulties of students who are deaf or hard of hearing into account.

Captioning
Bell (2020) recommends that captioning be used to support students who are deaf or hard of hearing during online learning. Captioning videos has actually been found to benefit a wide range of learners, including students learning a foreign language and those with English as an additional language, but according to a review of over 100 studies on the use of captions, can also typically developing students who are learning to read and even adults who are highly literate (Gernsbacher, 2015). Some may worry that subtitles lead to a distribution of attention between the written and the spoken word and argue that captions lead to additional cognitive load. However, a study using

EEG and eye-tracking to measure cognitive load (Kruger et al., 2013) found that the use of subtitles actually led to lower cognitive load and lower levels of frustration in their sample of English-medium university students in South Africa, which seems to suggest that adding captions to videos may be a fairly straightforward approach that could benefit all students, not just those who are deaf or hard of hearing.

Additional strategies that can help students that are deaf or hard of hearing to access course content include the following.

Strategies to support students who are deaf or hard of hearing

Plain language
McKeown and McKeown (2019) suggest that the use of plain language that is readable, clear, relevant, coherent, cohesive as well as effective and appropriate at conveying a message can aid the understanding of students who are deaf or hard of hearing. For example, Mike and Harrington (2013 in McKeown and McKeown 2019) found that simplifying assignment instructions and emails could benefit deaf students.

Knowledge organisers
Knowledge organisers are used increasingly with typically developing students (e.g. Miller, 2018) to help them activate their prior knowledge and link what they already know to new content. Research shows that these benefits also apply to students who are deaf or hard of hearing (McKewon and McKeown 2019).

Text features
McKeown and McKeown (2019) further suggest teaching students metalinguistic skills by making them aware of text features such as headings and subheadings, how they help to organise a text and how students can use them to help their understanding. The authors suggest that this could be achieved by teaching these strategies explicitly, developing a reading aid that guides students to specific parts in the text or previewing specific text features with them prior to task completion.

Visual aids
McKeown and McKeown (2019) further suggest that images are used to reinforce vocabulary learning. This could be done in a number of ways, by adding purposeful images (but not decorative ones as they can increase cognitive load), using visual glossaries, labelling images so it is clear to students which aspects of the image the text refers to and using multiple sources to explain abstract concepts.

Support vocabulary learning
Finally, they authors suggest that active vocabulary teaching support will benefit students who are deaf or hard of hearing. This could be achieved through glossaries and particularly visual glossaries could be beneficial (see above) or annotates text with hyperlinks or text boxes that explain complex terminology. All of these can, of course, also benefit all students.

Filming
Bell (2020) also provides a number of recommendations for educators who teach live lessons or want to record course content. These include wearing plain clothes (i.e. not busy) that contrast with the teacher's skin tone so as not to provide an additional distraction from their lip movements. This can help students who are deaf or hard of hearing and who are lip-reading. Additionally, it is important that the lighting in the room the recording or live lesson takes place is good and diffused so as not to cast shadows on the presenter's face as this could also impede lip-reading.

Group interactions
According to Bell (2020), it may also be useful to set ground rules for group interactions including turn-taking rules, using the 'raise your hand' feature and/or announcing who is speaking so students who are deaf or hard of hearing know who is speaking, making it easier for them to concentrate on the right image. Furthermore, Bell (2020) suggests that students turn off their cameras unless they are speaking to improve image quality and facilitate lip-reading. This may be particularly important in cases of low bandwidth. Reducing background noise by agreeing to stay muted unless somebody is speaking will also help students understand an ongoing conversation,

not only those who are deaf or hard of hearing. Finally, slowing down as a presenter and reminding students to slow down when they are contributing can also assist students who are lip-reading or relying on hearing aids.

Distance learning for students with visual impairments

Sometimes visual impairments can co-occur with other special educational needs and it is important to consider that students with co-occurring needs will require additional support to the strategies discussed below.

Online learning can afford significant advantages to individuals with visual impairments as it allows for a more personalised learning experience and the use of assistive technology can help students to access learning content more easily than they would be able to in a face-to-face learning environment (Kharade and Peese 2012; Alves et al., 2009; Permvattana et al., 2013).

Despite a number of advantages students with visual impairments also face a number of additional challenges in an online learning context when compared to their peers. These include the inaccessibility of some web or learning sites and materials (Permvattana et al., 2013).

Barriers to distance learning for students with visual impairments

Visual content
One of the main challenges raised by participants in an exploratory case study with students of online courses who have visual impairments (Kharade and Peese 2012) was the difficulty of interpreting graphic content when text descriptions - known as 'alternative text' or 'alt text' - are not provided. Usually, online learning platforms and websites allow backend users to provide labels for images and it is important for individuals using screen readers that these labels are informative and it is made clear if and how they relate to the text.

Scanned documents, PDFs, videos and PowerPoints
Participants in Kharade and Peese's (2012) study also highlighted difficulties with accessing scanned documents, PowerPoints and videos as these were not adapted to their screen readers. Editable documents should thus be given preference in online learning environments as these are more suitable for individuals relying on screen readers.

Cluttered pages and changing layouts
Kharade and Peese (2012) found that cluttered pages with a lot of information and many images were more difficult to access for participants in their studies. Individuals working with screen magnifiers only see a fraction of a page at a time, so it is important that the individual sections are as informative and clutter-free as possible. Furthermore, consistent layout between pages helps students who use screen readers or magnifiers to find the information they need more easily.

Real-time chat features and discussion boards
Results from Kharade and Peese (2012) also show that participants found real-time chat functions and discussion boards challenging as their screen readers are likely not adapted to them and the additional delay caused by the use of screen readers can make an interactive conversation challenging. Group work that relies on such features can be challenging as a result. Audio conversations may be more beneficial for students with visual impairments.

Learning management systems
Some integrated functions of the learning management system used by participants in Kharade and Peese (2012) also represented difficulties to students with visual impairments. These included integrated messaging/e-mail functions and students found it easier to use traditional email systems.

Strategies to support students with visual impairments

As outlined in the introduction to this section, it is important to focus on the learning objectives and the barriers that students with SEND face in reaching them rather than

merely on assistive technology and how to use it. Nevertheless, there are a number of strategies teachers can use to facilitate online learning for students with visual impairment; some are outlined by Cooper 2006:

- providing editable content (i.e. Word rather than PDF) so students can adapt font sizes and colours according to their needs
- checking that programmes are accessible and adapted to the use of screen readers
- making all information available in text format, including descriptions of images
- checking if software can be operated fully from the keyboard and without the use of a mouse
- providing context and orientation information, which can help with the use of screen readers.

Students from Kharade and Peese (2012) further suggest that teachers should:

- Ask students about their needs
- Compile course content into bundles, lesson by lesson and send it to students via email as Word documents
- Provide alternatives to real-time chat functions and discussion boards
- Avoid timed assessments
- Use consistent layout across pages and units
- Use contrasting colours.

Some of these may be easier for individual teachers to verify or adopt (e.g. providing editable content) while others may require the support of IT technician (e.g. checking if software can be operated from keyboard and is adapted to screen readers). It is important that accessibility considerations are taken into account at a school or national level when purchasing educational software or developing distance learning materials. Individual teachers can then focus on learning objectives and how best to support all students to meet them.

06

Digital equity and distance learning without the internet

Several research articles and reports refer specifically to the importance of digital equity, ensuring that all teachers and students have access to the internet and to the devices and technological resources required for effective distance learning to take place (Müller and Goldenberg, 2020; Dhawan, 2020)

In what has been termed 'the digital divide', this pandemic has seen disadvantaged students at risk of falling further behind their peers due to a lack of access to digital resources. In this way, technology can amplify rather than mitigate existing inequalities in the education system. The extent of this problem and its effects on the most disadvantaged students have been explored in several reports (Sutton Trust, 2021; UK parliament, 2020). Educators and policymakers need to think carefully about how this can be overcome in the face of future potential lockdowns and an ongoing need for some children to be taught remotely due to shielding or self-isolation.

Research conducted with teachers from primary schools in England (Moss et al., 2020) found that those working in more advantaged communities were more likely to report that home learning had been effective, compared with those teaching in deprived areas who raised greater concerns about the impact of lockdown on academic progression. Almost half of teachers working in the most deprived areas thought that the average student was engaged in school work for less than one hour per day when schools were closed in April. By May, half of these teachers reported that the majority of their pupils were doing no work at all (Moss et al., 2020). These findings were echoed in teacher surveys and focus groups conducted by Müller and Goldenberg (2020b), where teachers reported concerns about disadvantaged students. Eighty-eight per cent of survey respondents stated that some of their pupils did not have the internet or devices required to access online learning, with many teachers expressing that the situation had made them more aware of inequalities in their student population, and the extent to which these affected home learning.

This digital inequity exists between, as well as within, countries. In some parts of the world, students have a far greater chance of accessing the technology they need. In countries such as Austria, Denmark, Norway and Switzerland, over 95 per

cent of students have a computer they can use for schoolwork at home, in other countries such as Indonesia, only 34 per cent of students have access to such a device (Schleicher, 2020).

Technology availability within school is also an issue. Prior to the pandemic, less than half of the principals in Japanese schools felt they had adequately powerful digital devices in school, whilst across OECD countries, 40 per cent of principals said their internet speed was insufficient. In Singapore, parts of China and Denmark 90 per cent of 15 year old students are enrolled in schools whose principal felt that they had an effective online learning support platform in place in 2018, but in other countries such as Argentina, Morocco and Peru, this figure is only 30 per cent (Schleicher, 2020). In countries where schools already had an online learning system in place, they were more likely to be able to better handle the transition to remote teaching during the pandemic.

In many parts of the world there also are vast within-country differences between different socio-economic groups, for example in the USA almost every 15 year old in a socio-economically advantaged school has a computer to work on at home, whereas in disadvantaged schools, 25 per cent of students do not. The same can be seen regarding internet access. In Mexico, 94 per cent of 15 year olds from privileged backgrounds have internet access compared to 29 per cent from disadvantaged families (Schleicher, 2020).

Distance learning without the internet

As outlined in the introduction to this report, countries have used a range of non-internet-based approaches to distance learning such as television, radio or paper-based workpacks during the COVID-19 pandemic. Our own research also showed that schools in England have been using regular phone calls to parents and paper-based workpacks to ensure educational continuity for younger children and those without access to the internet while schools are closed to most students (Müller and Goldenberg, 2020b). In this section we will briefly present some non-internet-based approaches to distance learning that have been used during this crisis and in other contexts.

In the Distance Education Project for Rural Schools (DEPRS) project in China, which was first rolled out from 2003 to 2007, distance learning was implemented to address high illiteracy rates in the rural West (14 per cent higher than the national average) and a lack of qualified teachers in the region. Whilst in urban China 44.4 per cent of primary teachers had a college diploma or university degree, in the rural West this figure stood at only 15.6 per cent. Furthermore, there was a lack of teachers for certain subjects such as English, Music and PE, meaning that some subjects were no longer offered in rural areas and funding for education was a fraction of what was spent in cities (McQuaide, 2009). Distance learning was seen as a strategy to mitigate these educational inequalities and a way of sharing resources and teaching expertise between the East and the West of the country.

In elementary schools, serving grades 1–3 in the most rural areas, DVDs were used to facilitate learning. These DVDs contained recordings of nationally recognised teachers who were specialists in their subjects, and functioned as training tools for teachers as well as teaching input for students. Intermediate schools (grades 1–6) in larger villages also used these DVDs but in addition, they also had access to televised educational broadcasts. These lasted for 11 hours daily. A case study of Hubei province describes how the DVDs were used to teach English to students, and the way in which teachers were able to rewind and replay sections when students needed more time to grasp new concepts or words, as well as watching the DVDs themselves in advance of lessons, in order to improve their own English.

Local teachers were trained in how to incorporate the distance learning materials into their classroom instruction. This training took place both face-to-face and through the use of televised courses. By 2007, 100 million rural school children were able to access these educational resources (McQuaide, 2009). One notable difference from the COVID-19 pandemic is that these children were still attending local schools and

accessing the resources from within the classroom, alongside their teachers.

While there is no exam data available to measure the effectiveness of the programme, survey data from school principals and teachers involved suggests that it may have broadened students' intellectual horizons and made them more interested in studying. However, the survey results suggest it may not have had such a large impact on their practical skills, critical thinking and creativity. In one of the least-developed provinces, over 75 per cent of teachers felt that distance learning had improved student understanding of subject matter. But in the remaining 13 provinces, fewer teachers felt the project had tangibly impacted student learning. However, an evaluation of teaching English to elementary schools via television and DVD technology found that it had been successful in improving student pronunciation and conversational ability (McQuaide, 2009).

Several countries implemented the broadcasting of educational television programming in order to meet distance learning needs during COVID-19. However, this was not launched in the UK until January 2021. As outlined in a previous section, research has shown that young children can learn from television, and that television is indeed the most common medium that children interact with in younger years. However, the benefit of television programmes was only seen for shows that are interactive and encourage children to connect their lived experiences with what they see on television. It is important that these features are taken into account when television is chosen as an approach to distance education in times of crises.

In other countries such as Uganda and Afghanistan, where some students do not have access to television or radio, study materials were printed and distributed to students. However, producing and delivering these became problematic during the restrictions of the pandemic (Chabbott and Sinclair, 2020). Where children had textbooks at home, this situation was made easier. In some cases, parents were contacted by phone or announcements were made via radio to instruct parents regarding which pages of the textbook students should work on each day (Chabbott and Sinclair, 2020). In many schools children do not have access to their own copies of textbooks which they are allowed to take home with them. UNESCO has been drawing attention to the importance of textbooks for many years; in particular their importance in improving learning outcomes in low income countries with large classes and fewer qualified teachers (UNESCO, 2016). In their paper 'Every child should have a textbook', UNESCO claims that alongside an engaged and prepared teacher, 'textbooks in sufficient quantities are the most effective way to improve instruction and learning' yet access to them remains limited for millions of students UNESCO, 2016, p. 22). For this reason, some have claimed that in preparing for future emergencies, the highest priority for education should be both producing and distributing textbooks to children who don't have them, and training caregivers in how to help their child use these textbooks for learning (Chabbott and Sinclair, 2020).

The importance of printed learning materials and caregiver support has also been raised in research from refugee settings in the Middle East, which suggests that EdTech and e-learning have been mostly unsuccessful when applied to education in emergency settings (Qaddour, 2020). Qaddour asserts that there should not be an overemphasis on, or over-investment in, technology-based solutions in these contexts because, while there has been some successful use of familiar technology such as WhatsApp and YouTube in supplementing education interventions, on the whole, crisis-affected communities need simple and familiar solutions, not new and confusing technologies.

Finally, a mixed approach using printed materials, television and materials on an interactive learning platform was developed by the United Nations Relief and Works Agency (UNRWA) (El Khili, 2015) to support Palestinian refugees in Syria, and may be a way to build on the advantages of each medium to support learning during and after school closures.

Conclusion

Despite certain challenges that the online learning environment presents for students with and without SEND, it also holds significant advantages that can support students' learning. For example, the ability to learn at their own pace, access recorded materials as often as they need to, and use screen readers or adapt the layout of content easily to their needs, are only some of the benefits of learning in an online environment. Consideration should therefore be given to how those features of distance learning that have been found to be beneficial for students' learning through this crisis can continue to be implemented once schools reopen to more students.

Both teachers and researchers have noted the importance of using what we have learned throughout the pandemic to reconsider distance learning so that it can be used as effectively as possible in the future (Müller and Goldenberg, 2020b; Bozhurt et al., 2020). It is likely that this will not be the last interruption to education, and planning and preparation can enable better and more equitable solutions for next time. Bozhurt et al. (2020) point toward the importance of collaborating with psychologists and sociologists as well as developing distance education through both online and offline modes, focusing on equity so that the digital divide does not lead to a 'survival of the fittest' scenario.

There are myriad practical implementation issues and obstacles when teaching remotely during a pandemic; whereby conditions do not match the situations under which distance learning would usually occur. It is therefore essential to speak directly to teachers who have experienced educating their students remotely during this pandemic, and to glean from their insights and reflections what has worked well, what has not been effective and how this maps against the best practice recommendations from existing research.

To this end, the Chartered College of Teaching will soon embark on a research project to hear from teachers about the distance learning challenges they have faced over the past year, the innovative solutions they have found and their opinions on the most effective distance learning strategies. These will be shared in an upcoming report which will enable us to capture the latest developments and innovations in remote learning happening in schools across the world, as reported by teachers themselves, and to consider the extent to which teacher viewpoints on effective remote learning concur with existing research literature.

It is clear that teachers have learnt a huge amount about distance learning during the course of the past year, and have been admirably adaptable in the rapid transition to new ways of teaching and learning. The research detailed in this report can help to guide this ongoing journey and to support the future use of effective distance learning approaches, which may serve many benefits even after the pandemic is over – by supporting equal access to education for students who are unable to be in school, for example. However, there is still much to be explored in the field of distance learning and it is vital that teachers play a role in future research. At the Chartered College of Teaching we will enable teacher voice to be heard in this research so that the challenges, successes and innovations from this pandemic can be shared and learnt from across our worldwide teaching community.

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