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Senedd Cymru

Y Pwyllgor Plant, Pobl Ifanc ac Addysg

Welsh Parliament

Children, Young People and Education Committee

Kirsty Williams MS, Minister for Education

Dyddiad | Date: 14 September 2020

Pwnc | Subject: **Remote teaching and COVID-19 – approaches to school education**

Dear Kirsty,

In July 2020, as part of our ongoing work on the impact of COVID-19 on children and young people, we commissioned a rapid review of research and practical guidance on strategies to implement remote teaching and learning at school level, including examples in other countries. This work was undertaken by Professor Sofya Lyakhova from Swansea University, as part of Senedd Research's [Senedd Research COVID-19 Expert Register scheme](#).

This rapid review of research and guidance was commissioned before announcements about the return to school, and with a view to providing a constructive contribution to the ongoing contingency planning that our public services are undertaking in response to the pandemic. I attach a copy for yours and officials' reference, and hope that it will provide a useful source of information as you plan for the period ahead.

While this paper talks about remote learning, I would like to re-iterate our view that schools and colleges remaining open must be a top priority for all public services. The collateral damage caused to children and young people by this public health emergency has been significant. As such, we welcome the steps you took to ensure that our children and young people had an opportunity to attend 'check-in' sessions in schools and colleges before the summer break, and to return full time this autumn term. Whilst there remains a need for contingency planning, it is our view that school and college closures should only occur as a very last resort.

Yours sincerely,



Lynne Neagle MS

Chair

Croesewir gohebiaeth yn Gymraeg neu Saesneg | We welcome correspondence in Welsh or English.



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Remote Teaching and Covid-19 Approaches to School Education

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This paper has been produced under the [Senedd Research COVID-19 Expert Register scheme](#), through which relevant academics assist the Senedd with its work relating to both the COVID-19 pandemic and its impacts, with a particular focus on Wales. It was commissioned at the request of the Children, Young People and Education Committee to inform its [inquiry into the impact of the Covid-19 outbreak on children and young people in Wales](#).

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1. Introduction

The paper is a rapid review of research and practical guidance on strategies to implement remote teaching and learning at school level. The sources considered included both Covid-19 related reports and general research literature on remote teaching. Due to time constraints, this report is not a complete review of literature on the full range of remote and blended learning strategies. It should therefore be considered as a starting point from which discussions about remote teaching, whether implemented short or long term, could develop. The report focuses specifically on teaching and learning, although some wider issues around remote teaching implementation emerge.

There is a long-standing tradition of using interchangeable terminology in relation to remote teaching in research and professional literature. Therefore, we clarify the terminology first. Throughout the paper we refer to remote teaching whenever learners are separated from the teacher by distance for some time (perhaps not all the time). Remote teaching is viewed as the opposite of full-time face-to-face (or in-person) traditional classroom teaching and it could be

fully remote if there are no face-to-face activities. Essentially remote teaching means that students are in school for reduced (if any) time while the teaching continues when they are not. Remote teaching does not necessarily mean online as it could be based around print, TV or radio technology instead.

Any learning incorporates interactive and individual activities, such as classwork and homework in full-time face-to-face teaching. This feature is reflected in two attributes of teaching and learning called asynchronous ('in my own time', 'on my own') and synchronous ('at the same time', 'with others') activities. Remote teaching may incorporate synchronous activities (such as online lessons, collaborative chat) as well as asynchronous activities (such as viewing pre-recorded video, completing a computer-based test, reading a book or writing notes). Blended learning is a term traditionally used to highlight that a course is a combination of online and face-to-face learning, but it also emphasises that learning happens through activities that learners pursue on their own (asynchronous) and those that they do together with the teacher and/or other learners (synchronous).

The paper is organised as follows. Section 2 briefly introduces remote teaching in historical, theoretical, and educational terms. Evidence on Covid-19 practical approaches is considered in Section 3, including impact on learners, emerging advice on mitigating the impact and available school reopening plans. In Section 4, general approaches to remote teaching are discussed. Section 5 outlines the recommendations. Some selected terminology is printed in bold for easy navigation and should not be viewed as an enforcement of statements.

2. Remote Teaching: historical and educational contexts

Remote teaching (RT) historically originated in adult learning and is valued for the realisation of social justice and widening access in education and, at school level in particular, for efficient use of resources. Learner benefits and challenges of remote learning are well documented, see Table 1, and both relate to two main characteristics of RT (see, e.g., Lyakhova & Joubert and references within, 2019). These are limited opportunities for real-time social interaction and feedback, perhaps compensated by extended opportunities for reflection and individual work, and, related to this, assumed greater learner autonomy.

Table 1. Remote teaching at a glance.

Valued for	Known possible learner challenges (could be avoided)	Known possible learner benefits (not guaranteed)
<ul style="list-style-type: none"> - social justice and widening access in education - contributes to resilience in education through access, quality, cost and inclusion 	<ul style="list-style-type: none"> - student disengagement - low completion rates - increased feeling of isolation - higher workload - limited social interactions - independent learning skills are assumed - access to technology 	<ul style="list-style-type: none"> - access anywhere and anyhow (my pace/my place) - more inclusive environment - support for students who do not respond well to "traditional learning" (more able, less able, students with disabilities) - stimulates independent learning skills - strong association with learner achievements

This explains why improving student ability to self-direct learning, such as through learner **self-regulation**, is therefore seen important for RT (Kintu *et al.*, 2017). Learner self-regulation occurs when learners self-initiate and apply self-regulation strategies related to planning, evaluating and seeking help (see, e.g., Appendix A) to improve their learning. Self-regulated learners consciously use these to compensate for deficiencies in their learning habits, abilities, or environments. While self-regulation may be necessary for students coping with RT, adjusting to new learning environments may also stimulate growing self-regulation in learners. Social interaction and developing peer support and collaboration in classroom (whether online or traditional) are essential for stimulating self-regulation.

If the first forms of remote learning were mostly **asynchronous** ('in your own time'), such as when exchanging written and text sources by post, with the invention of radio and television **synchronous** ('at the same time') learning became available on large scales. Nowadays a **blended learning** course may incorporate face-to-face, live online and offline computer-based synchronous and asynchronous activities and may be designed for interacting with hundreds of thousands of learners.

Early comparative studies showed that **blended learning** (BL) courses may work better than either entirely face-to-face or entirely online education. This could be explained by the fact "the face-to-face classroom is collaborative before it is reflective", while the strength of online (asynchronous) learning is "the opportunity for reflection and rigour" (Garrison & Vaughan, 2008 p.19) and **blended learning** as a combination of interactive (**synchronous**) learning and online (**asynchronous**) learning opportunities integrates the strengths of both. The **asynchronous** component of BL has a strong association with learner achievements and is known to reduce cognitive load but to improve cognition and learning.

The element that creates and sustains learning is the teacher. Research showed that learners experience teacher presence differently in face-to-face and online learning (Garrison & Vaughan, 2008). Face-to-face learning experience is more teacher oriented where the teacher is seen as transmitting information, while online learning experience is more cognitively or internally focused. In the eye of learners, the role of the teachers in RT changes to being an instructor or facilitator of learning. Yet, pedagogically it remains the same, as in RT, as much as in any other teaching environment, the teacher's function is to provide structure, facilitation and direction for the progression of learning.

Arguably, planned remote teaching could facilitate social, cognitive and teaching presence and examples of good learner outcomes of remote teaching courses are available. However, the situation may be different in emergency remote teaching. It also may be different with younger learners as evidence on RT implementation at school level is lacking in general.

3. Emergency Remote Teaching and Covid-19 international trends in approaches to school education

Hodges *et al.* (2020) define Emergency Remote Teaching (ERT) as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances. It involves the use of fully remote teaching solutions for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses and that will return to that format once the crisis or emergency has abated". ERT's primary aim is therefore not about recreating a robust

educational system but is about arranging delivery modes, methods and media to respond to rapidly changing needs of educational institutions when access to resources, support and training is restricted for some but nevertheless limited time.

Numerous guidance and reports state that creative problem solving is needed in crisis circumstances (Hodges, 2020; Kanwar & Daniel, 2020; IBO,2020) that often require departure from normal pedagogical practices. For example, while **synchronous** courses may be preferable, **asynchronous** activities may be considered more practical if learners have difficulty in accessing synchronous courses. Furthermore, in certain circumstances ERT may reduce the role of educational institutions from teaching to providing **remote learning opportunities** only, thus shifting responsibility for **teacher instruction and progress monitoring** somewhere else, typically parents or students themselves.

While the terms teaching, instruction and learning may be perceived as interchangeable, caution is needed when interpreting these in the context of education reports on COVID-19. Some reports only appear to refer to remote learning opportunities that is to an offer made by education authorities or institutions to learners and families without references to teachers teaching or students learning. However, the teacher's role involves more than delivering learning tasks and activities to students. Therefore we considered both reports outlining trends in **remote learning opportunities** on offer and reports on how **teacher instruction and progress monitoring** were facilitated. While the reports available do not cover the same regions they nevertheless inform about the variations in teaching practices involved in COVID-19 ERT approaches.

3.1 Variations in remote learning opportunities internationally

According to the report published by the Brookings Institution on 14th April 2020 that uses data collected by the Centre for Global Development combined with the World Bank's classification, countries in the regions of East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, South Asia and Sub-Saharan Africa vary considerably in their approaches to education during COVID-19 by income, by region, by the type of online education resources and PISA-participation (Vegas, 2020):

- Only 10% of **high-income** but 75% of **low-income** countries do not provide remote learning opportunities. Among those that do provide **remote learning opportunities**, the majority among the low-income countries use TV and radio, while the high-income countries nearly all provide remote learning opportunities online with 20% using a combination of online and TV and/or radio broadcast.
- In all regions across the world, there are rural areas and those without internet connection that rely on **TV and radio** only. However, East Asia and the Pacific, Europe and Central Asia and Latin America and the Caribbean rely almost exclusively on **online** education.
- There are further variations among the countries using **online** educational resources. Among these countries more than 60% use online platforms and about one third distribute educational videos online. About 30% of countries suggest educational resources through social media and ministry of education websites. Only 12% publish modules containing instructional materials usually targeting specific grade levels. A small proportion (around 6%) employ video games.
- 85% of **PISA-participating** countries offer online educational opportunity. About 30% use online in combination with TV and/or radio broadcast education.

- Many countries appear to provide guidance to teachers for communicating with students but fewer countries provide **training on remote teaching**. Europe and Central Asia are the regions with highest proportion of countries providing training.

The data from Centre for Global Development (CGD, 2020) used in the report allows an insight into details of provision in at least some countries. Some common themes include access to technology and associated funding, differentiating between different age groups or households with different capabilities, facilitating multilingual provision and teacher professional development or learning. The data is not uniform and the examples below should not be treated as representative across regions or internationally.

Technology: online, TV, radio and print

New Zealand was one example of a country using various media to support remote teaching. TV lessons in New Zealand aimed at all age groups, including early learning, were broadcast at set times from 9am to 3pm every school day, with separate channels for English and Māori languages. Based on the success of these lessons, the broadcast of early learning and Māori lessons were extended until July 2020.

While New Zealand used a mixture of specialists delivering TV lessons, such as “teachers, presenters and wellbeing and movement professionals”, some countries emphasised that TV or radio lessons were delivered by some of their “best” teachers. In some countries such as Croatia, Czech Republic and Cyprus TV options were available for primary students while online options were used for secondary students. In some other countries radio lessons were used for primary and TV for secondary schooling. Whenever TV or radio was used, it was typically emphasised that it was available daily and at set times. Some countries expected parental supervision for watching or listening to these, noticeably for primary students and a set limit of time for watching TV was mentioned in some instances, such as 3 hours for primary school children.

Yet, there were countries where printed packs of resources rather than other forms of learning were used for primary students. And many more countries appeared to use these for learners of various ages whenever access to technology was difficult or rapid access was prioritised such as to help older students preparing for exams. In some instances, packs of printed materials such as homework booklets, were released at the start of the school closures to some students who could not follow an online learning programme, with the aim of collecting and grading student work in September. A follow up in terms of tuition classes to help students close the gap was mentioned in one instance. In New Zealand (2020a; 2020b), printed learning materials were sent to learners in the Māori-medium education pathway aged 0 to 18. Schools there were also able to order subject specific packs for students working towards a qualification with resources “available across more than 50 subject areas”. In early years packs went to learners most in need “due to disadvantage, or who do not have a computer or internet access”. In some countries printed packs and learner kits were specially issued for the emergency situation by the Ministry of Education, in other countries students continued using printed materials already familiar to them, including, for example in one country textbooks, workbooks, review books and activity books.

But transitioning from printed textbooks to their online equivalents were also seen as facilitating better access to learning. Authorities in several countries made all textbooks available electronically to parents free of charge during the COVID-19 crisis.

Online platform details often are omitted from the data but Google classroom is mentioned more often with some authorities emphasising live streaming facilities for synchronous learning being available. In respect to these, various arguments for using synchronous or asynchronous activities appeared. For example, Portugal argued that asynchronous activities, which “are less demanding in bandwidth and do not require state-of-the-art devices” should be prioritised, while synchronous activities were included in study plans for learners in Sweden. Additionally, there were instances of recreating several aspects of school environment virtually with online access to libraries and a librarian, with online help available from social support staff and psychologists being available.

Curriculum and Timetabling

Some instances of reduced curriculum were mentioned, such as mathematics, modern language, reading and writing, health and environmental education and hygiene subjects prioritised for primary phase and mathematics, modern language, technology, life and earth sciences and information technology prioritised in secondary phase during the school courses in one country. A different approach is taken in Luxemburg where it was announced that distance learning would focus on “essential content, including new contents, whose mastery is essential for the student to progress in his career school. When courses are resumed, the contents treated within the framework of distance education will be consolidated in class, before new learning is started”. While academic curriculum may be of prime concern, authorities in some countries reminded that meaningful education at home may not need to “just focus on academic or cognitive achievement”.

Some little detail on changes in the timetable is available. Luxemburg for example, decided to merge two terms into a single period of reference. In some countries some phases were offered schooling well into the summer holidays while other phases (such as primary schools) finished early.

Access to internet and digital devices

Facilitating Internet access and distributing digital devices was of concern to many countries. Some felt the urge to conduct a survey of technological devices available per household just before closing schools. Latvia for example estimated that 3% of their students were without laptop or smartphone. “In order to solve this problem promptly on the basis of the survey data, the Ministry of Education and Science addressed the telecommunications and communications companies” where the costs were to be covered by Ministry of Education contingency funds. In New Zealand (2020a, 2020b), more than 51,000 instances of internet connections were reported as completed or underway to be completed, more than 23,000 devices (laptops and Chromebooks) were to be supplied by the Ministry of Education and 16,000 devices were to be dispatched from schools’ own stock. For both internet connections and computers, the first priority was students working towards qualifications in order, in Year 12, Year 13, and then Year 11 students. “These priorities reflected the Government’s desire to minimise disruption for learners working towards a qualification, and the effectiveness of online teaching and learning for this age group” (New Zealand, 2020b). Appealing to private sectors and charitable organisations but also to general public for help when supplying devices to households was on the list for several countries. Others attempted to draw on the current funding available. One

province in Canada (Jefford, 2020), the country which was not included in the data analysed above, intended to divert funding for school buses and building maintenance which were reduced during the school courses to buy electronic devices for students. A different example of tackling technological inequality was to create a buddy system where a parent or student with internet and other capabilities would be attached to a student unable to access digital learning platforms. Additionally, the latter solution was seen to create environment for sharing and building community learning.

Learners with additional needs

Not only students with limited access needed differentiation. Luxemburg for example, announced that a systematic procedure was to be implemented at the national level to “clearly identify this target population and support the pupils concerned with a series of measures” including students with disabilities. Pakistan hoped that introducing TV lessons during the COVID-19 crisis may stay once the schools open to facilitate adult learning and improve access to education for students with limited capabilities.

Borrowing and Sharing of Resources

In the use of online resources, some countries relied on the resources developed elsewhere, such as by UNICEF. Estonia, the number one PISA-ranked country in Europe in 2018, announced sharing all of its digital education tools to support other countries’ education systems as part of Nordic countries support initiative during COVID-19 crisis. Resources were typically available in English and other languages. Sharing resources, perhaps in line with the advantages of online education, also happened within educational systems when distance learning was offered as MOOCs (Massive Open Online Courses).

Parental involvement

While one may assume schools would bear the overall responsibility for students’ learning even when teaching remotely, some countries emphasised the role of parents. The message varied from encouraging parents to home-school children during crisis to reminding parents about overall responsibility for children’s education to prioritising children’s wellbeing. In some cases, learners were also reminded about their responsibility to learn such as “I am responsible! My class is at home!” campaign launched in one country.

Teacher Training and approaches to ERT school guidance

There are examples of centralised approaches to schools policy and guidance, such as Ministries of Education developing and releasing remote teaching methodologies for secondary schools first and before work started on early phases. In other countries responsibilities for actions were delegated to schools and classrooms. Virtual teacher training on remote teaching was launched in various countries covering technology as well as new methodologies, pedagogies and didactics of distance learning and managing absenteeism. As one example, online literacy training for teachers but also parents was launched in Brazil. Timing of the training and instruction for schools was prioritised at the start of school closures. New Zealand but also other countries while bringing the start of the spring holidays forward for students, intended to utilise this period to “support schools to develop e-learning and other distance learning option for Term 2”. Singapore

was one country that “implemented a one-day-per-week homebased learning plan to help parents prepare for the possibility of extended home-based learning” in advance of school closures.

3.2 Variations in teacher instruction and progress monitoring: an example of the USA

The Brookings Institution report and the associated data considered above does not include North America because USA and Canada’s education systems are highly decentralised resulting in a greater variety of approaches taken. Indeed, a study by Gross and Opalka (2020) of COVID-19 school district policies in a nationally representative sample in the USA concluded that the variations in the expectations of what schools were to do are considerable. This study is of interest to us as it looks at the expectations about **teacher instruction, student engagement tracking and progress monitoring** which did not appear in other studies. Additionally, Gross and Opalka use the classification that may be viewed as exhaustingly describing all possible practices taking place during the COVID-19. The report reveals inconsistencies between the districts but also highlight variations in set expectations between **affluent** (“low free or reduced lunch districts”) and **poor** areas (“high free or reduced lunch districts”) as well as **urban** and **rural** areas.

The key findings of the USA report include:

- Two thirds of districts set low expectations for sustaining **teacher instruction**, see table 2. While 85% of the sample made some form of grade and subject specific curriculum materials, only 33% of districts expect all of their teachers to continue to engage and interact with all of their students around the curriculum content such as through live video lessons, recorded lectures, one-to-one support over phone, or feedback delivered through an online platform. This further diverge from 27% in rural areas to over 50% in in urban areas.
- Only 13.2% of districts expect live online (**synchronous**) lessons delivered to students. However, **affluent districts** (25% of all districts) are twice as likely as **high poverty districts** to expect their schools to provide live **synchronous** instruction (14.5% against 28.3%).

Table 2. School districts’ expectations on providing access to curriculum content and teaching during COVID-19 closures, adapted from Gross & Opalka (2020).

Indicator	Share	Definitions and Examples
Content:		
No curriculum resources provided	1.50%	None: no resources or expectations about curriculum, lessons or activities. General: menu of learning resources (not sequential lessons), such as links to Khan Academy, the local library system, kidsreads.com, etc. Could be a general list or organised by grade-level. Specific: Districts provide or expect schools to provide curated/directive curriculum, placing each student in a specific position in a resource and prescribing their pacing through resources, lessons/activities/units associated with a grade-level and a subject area, daily or weekly physical or downloadable packets that are distinct from the previous day or week's pack. These may be
General learning resources provided	10.10%	
Grade and subject specific resources provided	84.70%	
No closure info found	3.70%	

		created by the district, schools, teachers, or a third party.
Instruction from Teachers:		
ALL teachers are expected to engage with students around content via synchronous or asynchronous means.	33.50%	Yes: there is an expectation communicated that teachers will be providing instruction or instructional resources, not just uploaded assignments or work packets on a learning platform. Students are not expected to rely primarily on themselves or parents to understand content and assignments. This could happen via live instruction, pre-recorded video, online platforms, 1:1 conversations that are tied to content, or other strategies that ensure that students receive structured guidance on concepts.
SOME teachers are expected to engage with students around content via synchronous or asynchronous means.	13.20%	
No expectations	49.50%	
No information found	3.70%	
Synchronous Teaching:		
Synchronous teaching is expected for ALL teachers	7.90%	Synchronous = "real time" instruction to students over video conference. Offering office hours counts as a check-in, see Table 4, but does not count as synchronous teaching.
Synchronous teaching is expected for SOME teachers	13.90%	
No expectations	74.80%	
Info not found	3.70%	

- Only half of the districts set clear expectations on **monitoring student engagement** in learning, see Table 3, such as through attendance tracking or one-on-one check-in by phone or text. However, the largest divide in monitoring student engagement is between **urban and rural areas**: regular check-ins OR attendance taken are expected in 43% of rural areas against 65% in urban districts.
- Nearly 40% of districts do not require teachers to **monitor students' academic progress**, see Table 4. Only 42% of districts expect schools to collect student work, grade it and include the in the final course grade for at least some of their students. A higher proportion of districts (58%) expects their teacher to at least provide feedback (if not grade) for at least some of their students. The report remarks that these typically would be older students. As above, the largest divide in progress monitoring is between **urban and rural areas**: grading is expected in 57.2% of urban districts against 39.8% of rural districts and progress monitoring is expected in 52.6% of rural districts against 79.7% of urban districts.

Table 3. School districts' expectations on monitoring engagement and progress during COVID-19 closures, adapted from Gross & Opalka (2020).

Indicator	Share	Definitions and Examples
Attendance:		
Attendance taken	27.40%	Yes: districts communicates some process for capturing attendance, such as students are asked to log in to a virtual platform, to download

No expectation about attendance	68.90%	instruction or assignment via app, or to submit a response to "a question of the day", teachers may record attendance via phone call homes.
No info found	3.70%	
Teacher Check In:		
Check-ins are expected	36.90%	Yes: districts communicate that teachers will check in with students via phone call, email or virtual platform. Examples include: teachers calling students 1:1 to check in, teachers having office hours if students or families have questions; teachers having morning meetings or weekly wellness meetings.
No expectations about check-ins	59.30%	
No info found	3.70%	
Attendance OR Check In:		
Expected	48.00%	See above.
No expectations set	48.30%	
No info found	3.7%	
Feedback on student work		
Progress monitored for ALL students	48.00%	The lowest affirmative answer is when students are asked to submit some of their work to their teachers.
Progress monitored for SOME students	9.90%	
No progress monitoring expected	38.30%	
No info found	3.70%	
Formal grading		
Grading is done for All students	29.00%	Grading = formal grading, when districts require some student work to be completed during the shutdowns to contribute to their final score.
Grading is done for SOME students	13.10%	
No grading expected	54.40%	
No info found	3.70%	

A study by Lake and Dusseault (2020b) further exemplifies variations in set expectations:

- “all teachers [are required] to communicate learning objectives, activities and assignments to students weekly; interact with students in real time to deliver lessons and facilitate discussion; to archive lessons to access later”,
- teachers given three options to choose from: to support students with districts-developed materials, to engage in “a teacher-led hybrid instruction” or to opt for “fully digital instruction” (DPS, 2020). With the last option, teachers were expected to provide a fully online instruction and to communicate with students using phone or digital platform,
- decision making is delegated to schools without clear expectations.

Interestingly, while delivering instruction and monitoring students’ progress was reported as improved over the first few weeks of school closures, **grading, assessment and attendance** lagged behind (Lake and Dusseault, 2020a). Grading, and assessment pose difficult questions in the context of ERT. These may become an equity issue if not all students have access to technology and assignments. Yet, grading and assessment also provides motivation for learners to get on with work (Kurtz, 2020). Furthermore, although somewhat problematic to gather,

grading and attendance may prove valuable once school buildings reopen. Emerging practice included (Lieberman, 2020; Lake and Dusselaut, 2020b):

- completing Google forms at the start of the day, although this may prove time consuming with multiple children in one household,
- focusing on project completing dates rather than instructional time and using multiple parameters such as completed assignments, login in times and replies by email,
- giving students a few but not too many days for completing assignments and reaching the family after more than one assignment is missing,
- students earning an extra credit on work returned during the closures but otherwise not being penalised.

If in the previous section **differentiation by age** was noticed in respect to the choice of the media for ERT, differences in instruction by age became apparent from the USA studies (Lake and Dusselaut, 2020a and b; Kurtz, 2020). “Middle and high school students typically get more access to instruction and progress monitoring” (Lake and Dusselaut, 2020a, p.3). One district’s plan, for example, focused on “simplicity and literacy” for elementary students (Achievement First, 2020) where learning relied on students and parents self-direct use of online programme. In contrast, secondary and high school children were expected to have synchronous instruction via Zoom for each class in addition to using Google Classroom for assignments and instruction (Lake and Dusselaut, 2020b). Older students’ progress was monitored and assignments were graded, teachers were expected to check in daily and provide office hours.

Reasons for such differentiation were speculated to include (Lake and Dusselaut, 2020a):

- considerations of age-based learning differences such as limiting screen time for elementary students and needs of older learners such as preparing for exams and tests leading to qualifications being prioritised,
- secondary learners perceived as more prepared for online learning if they are equipped with devices already or experienced some form of remote learning before,
- digital platform being in place for older learners.

3.3 *Findings on Covid-19 ERT approaches impacting on children’s learning*

Many students may be expected to fall behind academically due to missing on instruction, low access to teachers, parents’ inability to support children and low engagement from students as a result of Covid-19 school closures. Yet, some small proportion of students may make additional gains in learning, particularly, in reading (Kuhfeld *et al.*, 2020) if the above factors are reversed or when students know how to self-regulate (to know what to do when they do not know and limited help is available) (Hattie, 2020a and 2020b). Additionally, this may depend on students’ emotional health and wellbeing.

The Brookings report (Vegas, 2020) suggests that the impact on some learners will be related to whether they have an opportunity to access **remote learning opportunities** or not and whether teachers get access to teacher **training on remote teaching**. But in high- and middle-class income countries and in **PISA-participating** countries, the impact is likely to depend on the actual quality of teaching taking place remotely, including **teacher instruction, progress monitoring and assessment**, rather than on the availability of learning opportunities (Vegas, 2020). According to Gross and Opalka (2020) it is worrying that in the challenge to produce a

range of remote learning opportunities or connect students to technology, variabilities in the level of instruction and learner progress monitoring, resulted in too many schools “leaving learning to chance during the coronavirus closures” (p.1). Providing opportunities for learning and providing quality learning experiences are not the same.

The study by Iqbal (2020) models three scenarios of the Covid-19 impact on students’ learning. According to one, the impact may be in average level of learning decreasing across the whole distribution. A different scenario shows that the impact may mostly affect students from lower **socio-economic backgrounds** while students from high-income families would continue to learn. The third scenario demonstrates that an increase in the number of school dropouts from lower economic backgrounds may occur.

Many reports agree with Iqbal *et al.* (2020) that the impact on students’ learning will vary depending on **socio-economic advantage** and **access to technology** (Kanwar & Daniel, 2020; Hattie, 2020b; Kurtz, 2020; Montacute, 2020). This may be because of how schools handle ERT (what they do and what they do not do) or in relation to **parents’ resourcefulness** (including parents’ ability to act as teachers of their children when, for example, parents themselves are well educated). The latter is especially important if one agrees with Hattie, that the experience of many learners during Covid-19 “was less ‘distance learning’ and more ‘home schooling’” (Hattie, 2020a).

Educators are most likely to be concerned with students falling behind in mathematics (Kurtz, 2020; Major & Machin, 2020; Montacute, 2020; Müller & Goldenberg, 2020) although learning English or other language are also mentioned in some studies (see, e.g., Kurtz, 2020). One study that considered previous data on absenteeism, regular summer breaks, school closures due to natural disasters or pandemics, projected that students were likely to return to school in September 2020 with 63-68% of expected scores in reading and 37-59% of expected scores in maths relative to a typical school year (Kuhfeld et al, 2020). According to another large-scale study in the USA, in May 2020 student participation in online math coursework from one online mathematics programme decreased by 69% and progress decreased by 58% compared to January 2020 (Track the Recovery, 2020). Another reason to worry about mathematics during and post-Covid-19 is that parental involvement in homework is known to have detrimental impact on children’s (especially boys’) mathematics-related performance and motivation (Silinskas & Kikas, 2019).

Both the youngest and oldest students may be at higher risk when ERT is used, but for different reasons. Entering a high school or college could be a life changing academic experience if it helps students to be more ambitious in their subsequent choices of work and education. School closures limit older students’ access to adults (teachers, counsellors, social workers) and peers who would normally support students making important decisions about their future (Carver, 2020; Harries, 2020). But the well-recognised summer learning loss effect may affect younger children’s progress more (Müller & Goldenberg, 2020).

Many students may face consequences for schoolwork not done during closures (Kurtz, 2020). These may amplify due to schools not being able to assess students promptly in September 2020 and then amplify further if schools have no strategies on how to mitigate these consequences quickly (Lake & Dusseault, 2020a).

Some more positive outcomes could be expected as well including:

- learner **digital confidence** improving as a result of Covid-19 blended learning as reported in Austria (Müller & Goldenberg, 2020),
- children becoming more **independent learners** as well as rediscovering the joy of learning once back in full time education as reported by Finland (Brookings Webinar, 2020),
- unplanned **teacher innovation** that happened during the pandemic benefiting learners beyond the crisis as reported by Finland (Brookings Webinar, 2020).

More generally, research suggests that those students who fall further behind during school closures, nevertheless, are likely to make most gains when they return to school (Kuhfeld *et al.*, 2020, Hattie, 2020b). In relation to this, some of the studies refer to the impact of 2010/11 earthquake in New Zealand where learner performance was lower in 2010 but not in 2011 when some affected regions performed higher than the country's average. Interpretations of this vary (Müller & Goldenberg, 2020). It may be due to an "earthquake impaired derived grade process" that allowed schools to apply for special dispensation for some (although not clear how many) students. But according to John Hattie this was due to teachers focusing on what students needed to learn rather than keeping students busy (Hattie, 2020b). Evidence from unplanned school closures sometimes do not agree on what effect it may have on learners and we refer the reader to Müller & Goldenberg (2020) for a more comprehensive discussion about these.

3.4 *Emerging advice on approaches to school education during and post-Covid-19*

The emerging advice relates to mitigating the impact outlined above as well as to building long term resilience in educational systems (EEF, 2020; Carver, 2020; Harris, 2020; Lake & Dusseault, 2020b; Kurtz, 2020; Hattie, 2020a and 2020b, Kanwar and Daniel, 2020, Bonilla *et al.*, 2020; Donaldson, 2020). Findings on short-term measures include:

- As an immediate response to the crisis schools and educational systems need to ensure **access to technology** but also **connecting learners to schools and teachers**, especially for disadvantaged pupils.
- Educational systems that are already using digital resources might find the transition to RT easier but **facilitating access to learning** and **further differentiation** of teaching is the key. John Hattie (2020a) proposes as many as ten groups of learners that may need more of (and/or different) teacher time: (1) students with low self-regulation who are highly dependent on teachers; (2) those who return with high level of stress, emotional concerns and/or behavioural issues; (3) students with no or low access proficiency in using quality strategies and guidance necessary to promote development; (4) students who have access to fewer educational resources; (5) students who already had a lack of progress in school; (6) students who have low expectations of themselves as learners; (7) those who lack proficiency in reading and numeracy skills, particularly, in early years; (8) students living in homes which are not safe; (9) students whose parents have low capacity or desire to engage in the schoolwork at home; (10) learners who prepare for high stake exams losing opportunity to engage.
- **School rules** may need to be re-examined including policies on contact hours, school performance measures but also rules against teachers interacting with students outside of school including social media that make sense during normal times but may be the opposite of what students need in emergency crisis.

- Some difficult decisions need to be made when implementing solutions that are unlikely to reach all the students. The emerging advice is to do all one can rather than stick to the rules that fit all as part of addressing the crisis as not implementing measures that do not fit all would contribute to further inequity all the same.
- In relation to **post-16 students** in particular, proactive advice and support should be provided to all students and especially those who may decide not to continue with their education. “The class of 2020 may have been graduated but should not be forgotten” (Bonilla *et al.*, 2020, p.1).
- Timely teacher **training on remote teaching** cannot be over-emphasised.

Long-term measures include:

- Continuing developing **technological systems** for education, including distance and open learning opportunities,
- Including scenarios for coping with crisis in **teacher training and professional development**. Finland, for example, expressed an opinion that their online teacher training implemented as part of wider policy on digitalisation helped teachers during the school closures (Brookings Webinar, 2020),
- Strengthen **independent learning skills**.

In relation to developing independent learning skills in learners’ long term, John Hattie claims that Australian schools that implemented his Visible Learning framework with the focus on learners becoming their own teachers, found the approach paid back during the Covid-19 school closures (Hattie, 2020b). The responses to the Visible Learning framework since it was introduced by Hattie in 2008 have been mixed (see, e.g., Terhart, 2011) but other measures, such as engaging learners in regular homework, collaborative learning, ‘**flipped classroom**’(see section 4) self- and peer-assessment and practices around assessment for learning could be employed to strengthen educational systems. One interesting example is Singapore where after the SARS outbreak in 2013, two days of home learning per year were introduced so teachers, learners and parents could practise RT environments (Hattie, 2020a). It is worth reinforcing that while RT requires learner’s maturity and self-regulation, distance learning environments are known to contribute to learner independence (see, e.g. Lyakhova & Joubert, 2019 and references within).

To address **learning losses** once students are back to school the following has been suggested (Bonilla *et al.*, 2020; Allensworth & Schwartz, 2020; Jones *et al.*, 2020):

- small-group or one-to-one interventions such as high-dosage tutoring that is directly tied to academic content should be prioritised,
- supporting learners’ additional needs in the general education classroom, condensed curriculum or repeating grade or year is recommended to be avoided,
- effective assessment of what students know but also how they feel need to be facilitated (Lake and Olson, 2020). It is recommend to engage parents as partners as part of school re-entry policy and to solicit parents’ observations about how their children’s strength, interests and learning habits developed but also to offer assessment literacy trainings,
- teacher training on assessment is recommended especially if teacher assessment is envisaged to replace standardised assessment (Müller & Goldenberg, 2020).

While many countries' end-of-year assessment systems appeared not to be resilient in the current crisis, there is a view that the role of **assessment** "is experiencing a renaissance as educators explore ways in which authentic assessment and feedback can be used to enable learning" (Kanwar & Daniel, 2020, p.9, see, also Contact North, 2020 for a list of trends in which assessment is changing during and after and the crisis). Permanently strengthening remote teaching including developing strategies for virtual assessment in parallel to preparing reopening schools is recommended (IE, 2020).

Finally, the advice on the approaches to ERT states that remote teaching can be effective if appropriate strategies are employed (Müller & Goldenberg, 2020) which we consider in section 4. Teaching quality is most important and is more important than how lessons are delivered (EEF, 2020). Factors that moderate the effectiveness of remote learning include teacher and student's readiness and capability and home learning environment and family support (Frankel, 2020). At practical level, peer interactions is found to improve learning outcomes in RT while peer collaboration can also provide motivation in RT (EEF, 2020).

3.5 Examples of school reopening plans from the USA

A report published on July 14th, 2020 states that three learning models are being considered (Lake & Dassault, 2020c): fully **in-person** teaching with social distancing; **fully remote teaching**; and a **hybrid** option that combines in-person and remote learning. All districts considered in the report are planning for at least two scenarios with some planning for all three. But less than a third of districts is not planning a fully in-person option. Some districts are planning "to open with fully remote instruction and gradually phase in an alternating day hybrid schedule by November, beginning with younger students" (p.4).

In relation to navigating families towards one or other model the following strategies are quoted:

- allowing students or families to opt out of **full-time remote** learning even when planning for full time in school teaching,
- asking parents to choose between either **full-time remote** or full-time **in-person** options before determining each school's schedule. "Schools with less than 75 percent interest in in-person instruction will have five days of classes a week, and schools with more than 75% interest will move to a hybrid option to reduce class size" (p.4),
- offering more than one **fully remote** option, such as (a) students receiving uploaded and live instruction from their school and (b) enrolling students for self-paced online school that employs local teachers but relies on the infrastructure of a state-wide virtual school.

With the **hybrid** model the preference is given to alternating day schedules that accommodates for teacher professional development, for opportunities to sanitize the school or for small group intervention with students who needs extra support. Examples include:

- splitting students into two cohorts, each receiving in-person learning two days a week and remote learning three days a week. This allows for one fully remote day a week with no students in school,
- splitting students into three cohorts that alternate one week in person and two weeks remote,
- splitting students into two cohorts with one week in school and one week remote with one day per week fully remote,

- offering primary students up to five days of in-person teaching, middle schools three to four days and high school students two days.

In addition to differentiating by age, examples of prioritised groups include students with disabilities, English learners or those who fall behind academically. Schools may be asked to monitor and refer more students as the year progresses. The report states that based on the feedback from parents about spring school closures, schools are planning to increase live instruction “to reduce family burden” (p.5).

4. Practical approaches to RT

Below we consider practical approaches to RT, based on a variety of sources including some practical guidance published specifically for Covid-19 and practice adopted by the FMSPW that has provided blended learning at school level in Wales since 2010 (COL, 2020; EEF, 2020; Finkel, 2020; FMSP, 2017; Golding & Bretscher, 2018; Hernández-García *et al.*, 2015; Hodges, 2020; IBO, 2020; IE, 2020; Imlawi *et al.*, 2015; Lyakhova & Joubert, 2019; Müller & Goldenberg, 2020 Sibley, 2020; S4, 2020; Appendix B).

Planning an RT course

According to Hodges *et al.* (2020), training, preparation and development of a fully online course could take nine months or more and at least two or three delivery cycles are needed before teachers become comfortable about a new mode of delivery. Planning, monitoring and reviewing an RT course is best to be done as a team effort. Subject to good planning (IBO, 2020), learning resources or even the whole courses could be shared between educational settings, while releasing more teacher time, school space and other resources to those learners who need it most.

Before planning teachers should have clarity on the following aspects:

- their institution’s policy on safeguarding, privacy and GDPR, recordings and channel of communications,
- infrastructure (what virtual room or recording facility, who supplies equipment and textbooks, is it enough for every learner),
- academic content of the course (what to teach),
- number of hours for synchronous (face-to-face or online) hours (potentially) available,
- high expectations on facilitating learning in between lessons (**asynchronous** mode) which is as important as actual lessons (**synchronous** mode) in RT.

Organisations experienced in remote teaching plan the whole course and often start by designing assessments that will be part of the course. Consider also what *new methodologies* and *new teaching skills* (screen sharing, recording, voice, room control, tools for delivering feedback) need to be acquired and how to achieve it. For example, in relation to managing behaviour for learning in online sessions, teachers need to address questions like “how do I know that students are present (that I am not simply talking to their machines)?” and “how do I know that students are learning?”. The approach will depend on many factors including the technological facility used, so considering how to harness the affordances of technology is important alongside the planning.

Synchronous, asynchronous and blended learning

There is evidence to suggest that **blending learning** as a combination of face-to-face and fully remote learning, may be as effective as classroom learning for many students (Frankel, 2020). But either mode has benefits and shortcomings, and either could support peer collaboration, see Table 4 below. Older learners may cope with, require and benefit from more flexibility, so **asynchronous** activities may work best for this group of students, while young learners may benefit from the structure of **synchronous** sessions.

Table 4. Online learning materials options (adapted and extended from Sibley, 2020).

Options for considerations	Advantages	Challenges
Pre-recorded lesson	<ul style="list-style-type: none"> - reusable - does not depend on full live attendance - editable - not dependent on a room's recording facility, can be recorded or hosted anywhere - one team member can make video for several people to use 	<ul style="list-style-type: none"> - several interactions may be needed to create quality materials that would last - no live interaction, communication or supervision - no feedback for either learners or teacher; content may not generate any learning, but teachers may not know - recording and editing can require paid-for software - can take a lot of drive space -
Live online lesson	<ul style="list-style-type: none"> - immediately responsive - offers supervision - allows a view of student responses in real time - creates a feeling of community - may serve for a variety of activities - collaboration may be achieved through chat, Q&A, screen sharing, polling and breakout rooms - opportunity to see one another face-to-face - may be informal, does not need over preparation 	<ul style="list-style-type: none"> - requires an Internet connection - must have a plan and backup plan - time is needed to familiarise with the room's features - may need another teacher to keep an eye on chat (visible to everyone) and Q&A (visible to teacher only) - managing online behaviour for learning may be challenging - Seeing direct faces may be exhausting, participants may find what feels like a continuous direct eye contact distressing - Some activities only suitable for small groups
Recording live online lesson	<ul style="list-style-type: none"> - reusable - keeps a record for safeguarding - available for absentees to catch up - learners like to revisit recordings to improve their understanding and when revising before the exam - self- or peer-reviewing recorded lessons for professional development 	<ul style="list-style-type: none"> - not fully reusable, e.g., errors stand - anonymity and data protection issues may be problematic - attendance may be affected - students may not want to be recorded

Showing direct faces when conducting an online lesson	<ul style="list-style-type: none"> - can create a sense of community - may be necessary for some content - may be necessary for some forms of assessment - may be needed for younger learner 	<ul style="list-style-type: none"> - careful consideration needs be given as to what is visible (data protection, safeguarding) - seeing direct faces could be exhausting and distracting - may feel like being closely watched
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In relation to **fully online learning**, a comparison study of two modes of teaching, **asynchronous** and **synchronous**, delivered by schools in China during the six weeks of Covid-19 found that school classes that received live online lessons (**synchronous**) had significantly improved learning outcomes in comparison to the classes where lessons were pre-recorded and sent by email (**asynchronous**) (Yao *et al.*, 2020). The study proposes that teachers should not only transmit knowledge but act as “leaders” and “accompaniers” in RT. At the higher education level, reduced opportunities for one-to-one discussions with students were identified by lecturers as important to compensate for, such as by offering additional and extended student consultations (Watermayer *et al.*, 2020).

Evaluating and authenticating students’ work online

Evaluating and authenticating students’ work online should take a holistic approach. Schools using a **learning management system** (LMS) may consider login time, collaboration data and submission data to evaluate how long and how often students were involved with assignments. Interviewing students about their work on a synchronous chat may help teachers to authenticate student work. Other advice includes

- creating assignments that are collaborative and working directly with groups of students,
- using plagiarism checkers,
- evaluating drafts before final submission (and providing feedback),
- creating libraries and pathfinders for students to use and quote in their assignments,
- creating questions and experiences that require learners to draw on their knowledge and experience,
- having a clear policy on submitting assignments and homework,
- maintain assignments that need to be handwritten and graded (by hand or online) if examinations and tests require students to write. The design of these needs to allow space for teacher feedback (see, e.g., S4, 2020).

Parental involvement and mentor roles

Studies of school children studying online noted that, in addition to the role of the tutor who is remote from the learner, a mentoring role need to be fulfilled (Hernández-García *et al.*, 2015; Imlawi, 2015). Parents are known to assume this role when they provide equipment, monitor students’ homework, make sure that children have time and space to complete online work and help them with the revision schedule. Greater parental involvement may be influenced by parents’ academic skill, availability, or interest (Lyakhova & Joubert, 2019) which may exacerbate equity issues during ERT.

Learner support.

Some students may be better equipped to learn remotely and independently than others, and establishing support for all learners is recommended through creating novel learning situations and supporting learners in developing new learning strategies. In addition to building various sources of formative feedback (automated, teacher and peer) into an RT course, practitioners may consider:

- implementing study skills modules or orientation days,
- establishing a pre-course assessment of academic knowledge but also of learner study skills, see e.g., learner self-regulation scale in Appendix A,
- creating clear expectations about different types of work required from students, such as homework, self-study, '**flipped classroom**' (see below), collaborative projects etc;
- helping students to create and follow a self-study schedule,
- establishing efficient learner access to teachers when working off campus,
- monitoring students' participation in lessons (listening, taking notes, answering/not answering questions, asking/not asking questions, taking part in polls, chat box, Q&A and other activities) and peer collaboration in lessons and between the lessons and arranging regular discussions with learners and families about these,
- informing parents about key events and deadlines in advance.

FMSPW top tips are:

- to create and share a study plan with the students at the start of the course outlining dates and topics of **synchronous** sessions (lessons, revision days, school visits) linked with **asynchronous** materials (pre-requisite materials, assignments and extension questions) for each lesson,
- to link some (but not all) of the assignments to standard examinations,
- to include interchangeable, printed and digital, sources for homework and self-study.

Remote Teaching or Flipped Classroom?

Some teachers may be familiar with a '**flipped classroom**' approach (FC) when students are introduced to new learning materials, such as via a short video, to watch at home. This allows more time for collaborative learning and higher problem solving in class (Oakes *et al.*, 2018). FC is different from BL but either approach could be useful for RT. In FC materials learnt at home prepare students for learning in class (synchronously) while in BL synchronous sessions (online or face-to-face) aim to prepare learners for learning independently.

Transitioning back from ERT

Transitioning back from ERT may also need to be planned as learners may have become accustomed to independent learning, shorter activities, asynchronous assignments, more freedom in their schedule and less face-to-face collaboration. Teachers may feel tired of rapid professional development, may not have had time to evaluate students work and may feel less confident that their remote teaching prepared students for traditional face-to-face assessments and exams.

5. Conclusions and Recommendations

In conclusion, RT is challenging and implementing it at school level would be a considerable innovation that needs adequate support. RT requires new approaches to learner scaffolding, assessment and feedback, different structure of a school ‘day’ or ‘week’ for both learners and teachers and further differentiation of teaching. There is no recognised methodological framework for implementing RT at the level of school, and particularly for younger children, and there is limited subject-specific evidence. When hints to successful approaches are available (such as for older students), the “fuzziness” of their definitions and terms is unlikely to allow for clarity on implementation and consequences of RT (Farley, 2020).

When implementing RT, it is recommended to consider the following at the level of school guidance and infrastructure:

- re-emphasising each learner’s entitlement to the curriculum and (a) facilitating access to resources and (b) setting consistently high expectations in relation to the quality of instruction, monitoring attendance, providing feedback and assessment,
- re-examining regulations and policy to allow RT-purposeful teaching innovation,
- strengthening teacher use of technology and assessment through professional development,
- creating the infrastructure to support the innovation.

In relation to the latter, it is recommended to consider if the structure developed for the new curriculum development could be utilised to support ERT and post-ERT teaching. A vertical structure where expert practitioners grouped by subject area could support subject-specific RT teaching approaches, while a horizontal structure where practitioners grouped by education phase (primary, secondary, post-16) could develop age-specific considerations. Linking with RT experts and HEIs’ education researchers may further support the innovation in teaching but also in the initial teacher training.

At the level of educational settings, it is recommended to consider:

- differentiating teaching so that it allows releasing more teacher time, school space and other resources to those learners who need it most. Generally, differentiating in access to in-person teaching is a common strategy deployed by countries moving towards remote teaching part time or full time (IE, 2020),
- facilitating sharing of resources between schools and teachers to allow more efficient use of teacher time for learner scaffolding but also for innovation,
- planned parental involvement and introducing mentoring roles,
- creating mechanisms for soliciting views from children, parents and teachers about what helps children learn remotely.

Teacher support could not be over-emphasised. Little evidence appeared at school level, but surveys of HEIs identified perceived feelings of “deprofessionalisation as pedagogues” among academic teaching communities in addition to feeling under-resourced when working from home (Watermeyer *et al.*, 2020).

In view of the evidence considered in this report, the immediate response when children are back to school should concentrate on mitigating consequences of learning losses, such as efficient assessment and individualised learner support; special attention may need to be paid to

mathematics. There may be issues around integrating NQT teachers in ERT or post-ERT environments.

To build long term resilience it is recommended to consider:

- developing RT courses in the areas where provision is weak or missing so that useful methodology and infrastructure could be developed and applied to more courses when in crisis,
- permanently strengthening independent learning skills as part of learning,
- strengthening channels for research-informed teacher innovation, professional learning and initial teacher training,
- continue investing into digital learning technologies.

Finally, consider if innovation in the curriculum delivery and teacher training that took place during Covid-19 school closures could benefit the ongoing curriculum reform, e.g., what practices may be beneficial to retain and what needs further development.

Appendix A. Learner self-regulation assessment (adapted and extended from Zimmerman & Pons, 1986).

Self-regulation categories	Examples of learner statements indicate that the strategies are self-initiated
Self-evaluation	"I check over my work to make sure I did it right."
Organising and transforming learning materials	"I annotate my notes."
Goal-setting and planning	"First, I start studying two weeks before exams, and I pace myself."
Seeking information from non-social sources	"Before beginning to write the assignment, I go to the library to get as much information as possible concerning the topic."
Keeping records and monitoring	"I took notes of the class discussion."
Environmental structuring	"I isolate myself from anything that distracts me.", "I turned off radio so I can concentrate on what I am doing."
Self-consequences	"If I do well on a test, I treat myself to a movie". "If my grade is not good enough, I will revise further".
Seeking social assistance	"If I have problems with maths assignments, I ask a friend/parent/teacher."
Reviewing records	Efforts to re-read tests, notes or textbooks and/or re-watch video.

Appendix B. Further Mathematics Support Programme Wales.

The Further Mathematics Support Programme Wales (FMSPW) is a Welsh Government funded initiative launched in 2010 with the purpose of widening access to Further Mathematics GCE AS/A2 level in Wales. FMSPW operates around six strands: professional learning, tuition and student support, free teaching resources, enrichment at pre-16, extra curriculum and enrichment at post-16, and research and innovation.

The programme provides tuition to students who cannot access Further Mathematics through their local schools or colleges if other options are not available to the students. FMSPW provision is a blended learning model that uses a combination of live online sessions, interactive resources for self-study and homework and face-to-face sessions (such as orientation days, study days, revision sessions and small group tutorials). FMSPW research into learner experience (Lyakhova & Joubert, 2019) showed the experience of learners is shaped by the technology and extended opportunities of asynchronous learning it offered.

Adobe Connect virtual classroom is used for synchronous online delivery. Teaching material (powerpoint) is uploaded in advance before each session. No personal video from teachers or students is streamed during sessions. Only teachers can share the content, all rooms are protected with passwords and participants are set in advance. In lessons participants observe a whiteboard with the powerpoint, where teachers write and explain tasks. Interactivity and opportunities for formative assessment are afforded by students answering questions via chat box, scribbling answers on screen and using the polling facility. Sessions are recorded for safeguarding purposes (MEI, 2020). Anonymised recordings are shared with all the participants and their schoolteachers. Students find revisiting lesson recordings beneficial and this is featured as one of the most useful elements of studying with the FMSP. *“The best thing is to be able to go back and review the work.”* Students use recordings to make more detailed notes in their own time, and to work on mathematical tasks in more detail. Students may revisit recordings three times or more, i.e., after the lesson when working on homework, for a quick re-cap before the next session and when revising for the exam.

In addition to extending their mathematics knowledge and skills, FMSP students perceive developed independent learning skills an important benefit of the FMSP course. For example, a student graduated in 2020 wrote that the course *“developed not only my mathematical ability but critical thinking and problem solving skills which will be extremely useful to me in the future regardless of whether my career is maths based or not”*.

References

- Achievement First (2020) 'Elementary school remote learning plan.' Available at https://docs.google.com/document/d/1avzF7Ebt0JSt1vZm2r_W6CaHdLLc9Q8I9Mxq3nPjaF4/edit# (accessed 31 July 2020).
- Allensworth, E. & Schwartz, N. (2020) 'School practices to address student learning loss.' Brief No.1. *EdResearch for Recovery*. Available at https://annenberg.brown.edu/sites/default/files/EdResearch_for_Recovery_Brief_1.pdf (accessed 31 July 2020).
- Bonilla, S., Carruthers, C. K., Baker, D. J. (2020) 'Guidance and Support for Students Moving into Postsecondary.' Brief No. 3. *EdResearch for Recovery*. Available at https://annenberg.brown.edu/sites/default/files/EdResearch_for_Recovery_Brief_3.pdf (accessed 31 July 2020).
- Brookings Webinar (2020) 'Education and structural inequalities during Covid-19: how Finland and the US compare.' *Brookings Institution*. Available at <https://www.brookings.edu/events/education-and-structural-inequalities-during-covid-19-how-do-finland-and-the-us-compare/> (accessed 31 July 2020).
- Carver, L. B. (2020) 'Supporting learners in a time of crisis'. *Advances in Social Sciences Research Journal*, 7(4), 129-136.
- CGD (2020) 'CGD – Covid education Policy Tracking.' *Centre for Global Development*. Available at <https://docs.google.com/spreadsheets/d/1ndHgP53atJ5J-EtxgWcpSfYG8LdzHpUsnb6mWybErYg/edit?ts=5e6f893e#gid=0> (accessed 31 July 2020).
- COL (2020) 'Guidelines on Distance Education during COVID-19.' *Burnaby: COL* Available at <http://oasis.col.org/handle/11599/27> (accessed 31 July 2020).
- Contact North (2020) 'Ten Radical Ways Assessment is Changing.' *TeachOnline.Ca*. Available at <https://teachonline.ca/tools-trends/ten-radical-ways-assessment-changing> (accessed 31 July 2020).
- Donaldson, G. (2020) 20 June 2020. Available at <https://twitter.com/ghcdon?lang=en> (accessed 21 June 2020).
- DPS (2020) 'Remote learning plan for emergency closures of DPS schools.' *Denver Public Schools*. Available at https://www.dpsk12.org/wp-content/uploads/2020_remote_learning_plan.pdf (accessed 31 July 2020).
- EEF (2020) 'Remote learning: Rapid Evidence Assessment.' *Education Endowment Foundation*. Available at https://educationendowmentfoundation.org.uk/public/files/Publications/Covid-19_Resources/Remote_learning_evidence_review/Remote_Learning_Rapid_Evidence_Assessment.pdf (accessed 31 July 2020).
- Farley, C. (2020) 'Exploring the evidence on virtual and blended learning.' *Research Alliance for New York City Schools*. Available at https://research.steinhardt.nyu.edu/scmsAdmin/media/users/ks191/Research_Alliance_Summary_of_Evidence_on_Remote_and_Blended_Learning_final.pdf (accessed 31 July 2020).
- Finkel, A. (2020) 'Differential learning outcomes for online versus in-class education, A report to Minister of Education, Australia by Australia's Chief Scientist.' *Rapid Research Information Forum*.
- FMSP (2017) 'A guide to studying Further Mathematics with FMSP Wales.' Further Mathematics Support Programme Wales, Swansea University. <https://furthermaths.wales/files/Tuition-Booklet-English.pdf>
- Garrison, D. R., & Vaughan, N. D. (2008) *Blended learning in higher education: Framework, principles, and guidelines*. John Wiley & Sons.

- Golding, J., & Bretscher, N. (2018) 'Developing pedagogies for a synchronous online course on teaching pre-university mathematics.' *Teaching Mathematics and its Applications: An International Journal of the IMA*, 37(2), 98-112.
- Gross, B. & Opalka, A. (2020) 'Too many schools Leave Learning to chance during the pandemic.' *Center on Reinventing Public Education (CRPE)*. <https://www.crpe.org/publications/too-many-schools-leave-learning-chance-during-pandemic> (accessed 31 July 2020).
- Hattie, J. (2020a) 'The New Normal of Learning: Build Back Better.' *Corwin Connect*. Available at <https://corwin-connect.com/2020/05/the-new-normal-of-learning-build-back-better/> (accessed 31 July 2020).
- Hattie, J. (2020b) 'Visible Learning Effect Sizes When Schools Are Closed: What Matters and What Does Not.' *Corwin Connect*. Available at <https://corwin-connect.com/2020/04/visible-learning-effect-sizes-when-schools-are-closed-what-matters-and-what-does-not/> (accessed 31 July 2020).
- Hattie, J. (2008) *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. NY: Routledge.
- Harries, D. (2020) 'A broad strategy for schools during Covid-19 pandemic.' *Brookings Institution*. Available at <https://www.brookings.edu/blog/brown-center-chalkboard/2020/03/27/a-broad-strategy-for-schools-during-the-covid-19-pandemic/> (accessed 31 July 2020).
- Hernández-García, Á., González-González, I., Jiménez-Zarco, A. I. & Chaparro-Peláez, J. (2015) 'Applying social learning analytics to message boards in online distance learning: A case study.' *Computers in Human Behavior*, 47, 68-80.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020) 'The difference between emergency remote teaching and online learning.' *Educause Review*, 27.
- Jones, N., Vaughn, S. & Fuchs, L. (2020) 'Academic supports for students with disabilities.' Brief No. 2, *EdResearch for Recovery*. Available at https://annenberg.brown.edu/sites/default/files/EdResearch_for_Recovery_Brief_2.pdf (accessed 31 July 2020).
- Jefford, S (2020) 'Online learning begins for students across Ontario as COVID-19 closures continue.' *Global News*. Available at <https://globalnews.ca/news/6782511/ontario-online-learning-covid19-coronavirus/> (accessed 31 July 2020).
- IBO (2020) 'Online learning, teaching and education continuity planning for schools.' *International Baccalaureate Organisation*. Available at <https://www.ibo.org/globalassets/news-assets/coronavirus/online-learning-continuity-planning-en.pdf> (accessed 31 July 2020).
- IE (2020) 'Reopening Schools: Global Update #3. Synthesis & Insights From Countries' Experiences.' *Insights for education*. https://img1.wsimg.com/blobby/go/104fc727-3bad-4ff5-944f-c281d3ceda7f/20200715_0819_Covid%20Reopening_Country%20Experien.pdf (accessed 31 July 2020).
- Iqbal, S. A., Azevedo, J.P., Geven, K., Hasan, A. & Patrinos, H.A. (2020) 'We should avoid flattening the curve in education – Possible scenarios for learning loss during the school lockdowns.' *World Bank Blogs*. Available at <https://blogs.worldbank.org/education/we-should-avoid-flattening-curve-education-possible-scenarios-learning-loss-during-school> (accessed 30 June 2020).
- Imlawi, J., Gregg, D. & Karimi, J. (2015) 'Student engagement in course-based social networks: The impact of instructor credibility and use of communication.' *Computers & Education*, 88, 84-96.
- Kanwar, A & Daniel, J. (2020) 'Report to Commonwealth Education Ministers: from response to resilience.' *UNESCO*. Available at <https://iite.unesco.org/publications/report-to-commonwealth-education-ministers-from-response-to-resilience/> (accessed 31 July 2020).

- Kintu, M. J., Zhu, C., & Kagambe, E. (2017) 'Blended learning effectiveness: the relationship between student characteristics, design features and outcomes.' *International Journal of Educational Technology in Higher Education*, 14(1), 7.
- Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., & Liu, J. (2020) 'Projecting the potential impacts of COVID-19 school closures on academic achievement.' *EdWorkingPaper*. 20-226. Available at <https://doi.org/10.26300/cdrv-yw05> (accessed 31 July 2020).
- Kurtz, H. (2020) 'National survey tracks impact of coronavirus on schools: 10 key findings.' *Education Week*.
- Lake, R. & Dusseault, B. (2020a) 'Districts and CMos are making progress on instruction and monitoring, but lag in grading and attendance.' *Center on Reinventing Public Education (CRPE)*. Available at <https://www.crpe.org/thelens/districts-and-cmos-are-making-progress-instruction-and-monitoring-lag-grading-and-attendance> (accessed 31 July 2020).
- Lake, R. & Dusseault, B. (2020b) 'School systems make a slow transition from the classroom to the cloud.' *Center on Reinventing Public Education (CRPE)*. Available at <https://www.crpe.org/thelens/school-systems-make-slow-transition-classroom-cloud> (accessed 31 July 2020).
- Lake, R. & Dusseault, B. (2020c) 'First District Reopening Plans Illuminate Tradeoffs and Confusion in Politically Charged Environment.' *Center on Reinventing Public Education*.
- Lake, R. & Olson, L. (2020) 'Learning as We Go: Principles for Effective Assessment during the COVID-19 Pandemic.' *Center on Reinventing Public Education*.
- Lieberman, M. (2020) 'Taking attendance during coronavirus closures: is it even worth it?' *Education Week*.
- Lyakhova, S. & Joubert, M. (submitted Dec 2019) 'Post-16 Further Mathematics: learner self-regulation, mathematical resilience and technology.'
- Major, L. E. & Machin, S. (2020) 'Covid-19 is increasing the divide in life chances between rich and poor.' *LSE Business Review*.
- MEI (2020) 'MEI Safeguarding and Child Protection Policy.' Mathematics in Education and Industry. Available at <https://mei.org.uk/safeguarding> (accessed 31 July 2020).
- Montacute, R. (2020) 'Social Mobility and Covid-19: implications of the Covid-19 crisis for educational inequality.' *The Sutton Trust*.
- Müller, L. M., & Goldenberg, G. (2020) 'Education in times of crisis: The potential implications of school closures for teachers and students.' *Charter College of Teachers*.
- New Zealand (2020a) 'Learning at home key messages for former refugee and migrant families.' *EDUCATION.govt.nz*. Available at <https://www.education.govt.nz/assets/COVID919-files/Home-Learning-messages-for-migrant-and-refugee-families-English.pdf> (accessed 31 July 2020).
- New Zealand (2020b) 'Home learning COVID-19.' *EDUCATION.govt.nz*. Available at <https://www.education.govt.nz/covid-19/distance-learning/> (accessed 31 July 2020).
- Oakes, D., Davies, A., Joubert, M., & Lyakhova, S. (2018) 'Exploring teachers' and students' responses to the use of a Flipped Classroom teaching approach in mathematics.' *BSRLM*, 38, 1-6.
- Sibley, J (2020) 'What not to do in an online classroom.' *MEI conference*.
- Silinskas, G., & Kikas, E. (2019) 'Parental involvement in math homework: Links to children's performance and motivation.' *Scandinavian Journal of Educational Research*, 63(1), 17-37.
- S4 (2020) 'The S4 Bumper Workbook of Key Stage 3 home science.' Swansea University.
- Track the Recovery (2020) <https://www.tracktherecovery.org/> (accessed 31 July 2020).

Terhart, E. (2011) 'Has John Hattie really found the holy grail of research on teaching? An extended review of Visible Learning.' *Journal of curriculum studies*, 43(3), 425-438.

Vegas, E. (2020) 'School closures, government responses, and learning inequality around the world during COVID-19.' *Brookings Institution*. Available at <https://www.brookings.edu/research/school-closures-government-responses-and-learning-inequality-around-the-world-during-covid-19/> (accessed 31 July 2020).

Watermeyer, R., Crick, T., Knight, C., & Goodall, J. (2020) 'COVID-19 and digital disruption in UK universities: afflictions and affordances of emergency online migration.' *Higher Education*, 1.

Yao, J., Rao, J., Jiang, T., & Xiong, C. (2020) 'What Role Should Teachers Play in Online Teaching during the COVID-19 Pandemic? Evidence from China.' *Sci Insight Edu Front*, 5(2), 517-524.

Zimmerman, B. J. & Pons, M. M. (1986) 'Development of a structured interview for assessing student use of self-regulated learning strategies.' *American Educational Research Journal*, 23(4), 614–628.