

The influence of COVID-19 on the independent study habits of learners

Research

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Influence of COVID-19 on the independent study habits of learners

Audience This report is for Welsh Government policymakers; school leaders and practitioners responsible for supporting learners with independent work; middle tier organisations (i.e., local authorities, ESTYN, School Improvement Agencies); organisations in Wales responsible for promoting and supporting learners develop independent study skills.

Overview This report explores the independent study practice of school learners aged 14–15 and 16–17 years in Wales since the start of the school closures caused by the COVID-19 pandemic until the present day. This includes learners' use and understanding of common learning strategies and study resources, effort towards independent work, confidence towards using digital learning platforms and independent study activities, sourcing knowledge on learning strategies and study resources as well as the support learners received from schools for independent work.

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Action required The report findings have been shared with Welsh Government for their consideration.

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Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.

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Executive Summary

The purpose of the current research study was to understand and explore the influence of the pandemic on the independent study practice of learners aged 14–15 and 16–17 years in middle and secondary schools in Wales.

We explored learners' use and understanding of a variety of learning strategies and study resources, as well as how learners felt about undertaking independent study activities and using digital learning platforms. In addition, we explored the sources of learners' knowledge of learning strategies and study resources and how schools supported learners with independent study.

We conducted a cross-sectional survey with learners in mainstream middle and secondary schools in Wales. To measure learners' independent study practice, we asked learners to complete the Effective Revision and Study Strategies Questionnaire (ERaSSQ). Our survey of learners provides the following insight about learners' study practice during the COVID-19 pandemic and at the present time.

Summary of survey findings

Learners' use of learning strategies and study resources:

1. The study resources that were used most frequently were information/notes in learners' class book/folder and information notes uploaded by teacher(s) on the school's digital learning platform.
2. The online study resources that were used most frequently were the WJEC website, BBC Bitesize and the Welsh Government's Hwb platform.
3. The majority of learners used lower utility strategies when using the WJEC website, BBC Bitesize and the Welsh Government's Hwb platform for study, including highlighting and/or underlining information/text, reading information/notes over and over and making notes and/or summarising information.
4. A minority of learners used the learning strategies categorised as having higher utility, such as retrieval and spaced practice techniques, when accessing the WJEC website, BBC Bitesize and the Welsh Government's Hwb platform for study.
5. Overall, learners reported using both less and more effective learning strategies whilst accessing the frequently used study resources for independent work. Learners' choice of strategies has not changed over recent years and, importantly, despite the need for learners to work more independently during the COVID-19 school closures, learners' use of learning strategies has not changed since the start of the pandemic.

Learners' understanding of the effectiveness of learning strategies and study resources:

1. The learning strategy that scored most highly as being effective was making notes and/or summarising information. This strategy was categorised as a lower utility strategy by Dunlosky et al. (2013).
2. Retrieval practice, categorised as having higher utility by Dunlosky et al. (2013) for enhancing learning, was also rated highly. However, when interpreting these promising results, it is important to consider that around half (49%) of learners

reported that they would complete retrieval practice activities to assess their learning and fewer than a third (30%) would use retrieval practice as a learning strategy.

3. Our survey findings indicate that despite the need for learners to work more independently during the COVID-19 school closures, learners' understanding of the effectiveness of some common learning strategies has not changed since the start of the COVID-19 pandemic.
4. The study resource that was rated most highly as being effective was information/notes in their class book/folder.
5. Two additional study resources were also rated highly as being effective, including using text book/guide and information uploaded by teacher(s) on school learning platforms.
6. Online study resources such as Seneca learning and Oak National Academy were rated as being less effective. (Seneca learning is an online learning resource developed by researchers and is based on retrieval practice, a more effective learning strategy.)
7. The findings indicate that learners were not fully aware of the utility of study resources such as Seneca learning. One reason could be learners' lack of experience using external study resources prior to the COVID-19 school closures, and these findings indicate learners would benefit from receiving more information about the utility of study resources to help them learn.

Learners' knowledge of the benefits of using retrieval practice, spaced practice, flashcards and mind maps as learning strategies:

1. Around half (49%) of the learners reported that retrieval practice would help them to assess their learning by identifying what they know and do not know. A minority (30%) of the learners reported that they would use retrieval practice as an effective learning strategy. This finding suggests that most learners were not aware of the advantage of using retrieval practice as a learning strategy when studying/revising.
2. Half (53%) of the learners reported that spacing practice would have helped them to learn and remember information when studying/revising, suggesting that learners understand that spacing is beneficial for learning.
3. Half (51%) of the learners identified the long-term benefits of distributing study sessions over time and only a few (16%) believed that studying in only one session was a superior strategy. Our survey findings on spaced practice suggest that most learners were aware that spacing is beneficial for learning. However, when interpreting these promising results, it is important to consider that we have previously found that only a minority of learners were using spaced practice whilst accessing the various study resources.
4. Around a third of learners (36%) reported that using flashcards would help them recall information, suggesting that learners were using flashcards in an effective manner. However, 28% of learners reported that using flashcards would allow them to read information over and over (a less effective learning approach). This suggests that some learners might not understand the utility of using flashcards as an effective study tool.
5. Less than a third (31%) of the learners reported that using mind maps would help them link information between topics and help them make sense of connections. A similar proportion of learners (30%) reported that using mind maps would allow them to reread information over and over, which is a less effective strategy.

6. Despite the lockdown and the need for learners to complete schoolwork on their own, learners' independent study practice and knowledge of the utility of learning strategies has not changed.

Time spent on independent work:

1. Around half (41%) of the learners spent more than seven hours a week on schoolwork.
2. The number of hours learners reported spending on independent study per week during the school closures varied between none (11%) and more than 7 hours per week (12%).

Confidence in using digital learning platforms and confidence towards independent study activities:

1. Our findings show that learners' confidence with using digital learning platforms such as *Hwb Platform, Microsoft Teams, Google Classroom, Moodle* and *Show My Homework* has improved over the period following the first COVID-19 school closures (March 2020 to May 2022).
2. Learners' confidence in using the six digital learning platforms have improved since March 2020 at different rates for the various platforms.
3. The digital learning platform where learners had gained more confidence to use over the lockdown was *Microsoft Teams*.

Learners' confidence in undertaking independent study activities:

1. Learners rated feeling *slightly confident* in undertaking most of the study activities at the start of the COVID-19 school closures. This included undertaking the following activities: *learning schoolwork on my own outside of school without help from school teacher(s); using online learning resources; using the internet for finding effective (i.e., helpful) learning resources; using effective (i.e., evidence-informed) learning strategies; using the internet for finding effective (i.e., helpful) learning strategies; using offline learning resources (e.g., textbooks, study/revision guides); studying on my own outside of school (i.e., doing work other than homework); revising on my own in preparation for class tests; and, practising external exams at home.*
2. The study activity learners scored most highly as feeling confident in undertaking at the start of the school closures was *using the internet for finding effective (i.e., helpful) learning resources* and learners rated feeling *somewhat confident* in undertaking this activity.
3. An important study activity where learners had gained more confidence to use over the lockdown was *learning schoolwork on my own outside of school without help from school teachers (s).*
4. Overall, there was a clear improvement on learners' confidence in undertaking the listed study activities with respondents giving a higher rating to all the study activities at the present time of completing the survey compared to at the start of the COVID-19 school closures.

Source of knowledge on learning strategies and study resources:

1. Many (83%) of the learners identified their school teacher as the source of knowledge on learning strategies. Similarly, many (82%) learners identified their school teacher as the source of knowledge on study resources.
2. Half (58%) reported that their knowledge of learning strategies were derived 'online' and half (53%) identified their friend(s) and/or peers as the source of their knowledge on learning strategies.
3. Similarly, half (59%) reported that their knowledge of study resources was derived online and half (56%) identified their friend(s) and/or peers as the source of their knowledge on study resources.
4. A minority (40%) reported that their knowledge of learning strategies were derived from parents/carers.
5. Similarly, a minority (35%) reported that their knowledge of study resources were derived from parents/carers.

Support from schools with home learning and demand among learners:

1. Learners rated the support received from schools to help them with their home learning as being moderately helpful, for example using the school's digital learning platform as well as using other online platforms such as Google Classroom, Microsoft teams to access schoolwork and/or to communicate with your school teacher(s).
2. Our findings also show that many (71%) learners would welcome more information about effective learning strategies and study resources.
3. In addition, many (83%) learners reported that they should be provided with information about effective learning strategies and study resources to support their independent learning in the event of future emergencies.

Recommendations for Welsh Government

1. Welsh Government should communicate the importance of independent learning skills, and provide guidance to improve teachers' knowledge of higher utility independent learning skills that learners can use in secondary and further education settings.
2. Welsh Government should ensure that an appropriate repository of study skill resources is made available for schools and colleges to help learners use more effective study and revision strategies across a range of subject areas.
3. Welsh Government should also work with the regional consortia and Estyn to ensure that schools receive appropriate guidance and best practice case studies to help embed the use of effective learning strategies in education settings.

Recommendations for middle tier organisations (i.e., Local Authorities, ESTYN, School Improvement Agencies, Qualifications Wales)

4. Middle tier organisations should work with Welsh Government and schools to communicate the importance of independent learning skills by providing guidance to improve teachers' knowledge of higher utility independent learning skills to help learners in secondary and further education settings.
5. Middle tier organisations should monitor the implementation of independent learning intervention programmes in school and college settings. They should ensure initial

teacher education programmes, and support for newly qualified teachers, includes provision for understanding the importance of supporting learners to use effective independent learning skills.

Recommendations for school leaders and practitioners

6. Schools should work with teaching staff to more clearly exemplify effective independent study and revision strategies. Schools should also provide learners with information about how to use some of the more effective learning strategies such as retrieval and spaced practice and communicate the importance of how these strategies can be used as part of purposeful independent learning and revision.

Recommendations for future research

7. Our study did not evaluate parents' and carers' understanding of independent learning skills. Future research should be conducted with parents and carers to explore how they can promote the use of effective learning strategies at home.

1. Introduction

As part of the Welsh Government National Strategy for Educational Research and Enquiry (NSERE), the Collaborative Evidence Network (CEN) programme of research was established in 2020 to share evidence on the impact of the COVID-19 pandemic on the Welsh education system. In June 2020, Welsh Government commissioned higher education institutions in Wales to undertake the first CEN research studies to understand and explore the influence of the pandemic on the education system in Wales.

In November 2021, Welsh Government commissioned universities in Wales to undertake additional CEN studies. The Collaborative Institute for Education Research, Evidence and Impact (CIEREI), School of Educational Sciences, Bangor University, was awarded a total of twelve projects to investigate the impact of the COVID-19 pandemic across the school system and on important learner groups. The Bangor University CEN programme of research focused on learners, support staff, school leaders, parents/families/carers, and academic staff across the education system in Wales.

The purpose of the current study was to understand and explore the influence of the pandemic on the independent study practice of learners aged 14–15 and 16–17 years in middle and secondary schools in Wales. We asked learners about their experiences of using a variety of learning strategies and study resources for independent learning (i.e., to complete schoolwork, study and/or revision) whilst at home, the time spent on schoolwork and study, and how they felt about independent learning activities and using digital learning platforms. Importantly, we also evaluated learners' understanding of learning strategies and study resources, their source of knowledge of learning strategies and study resources and how schools supported learners with independent study/remote learning. The aim of this research was to gather evidence to inform Welsh Government's Renew and Reform plan and other post-pandemic education policy.

1.1 COVID-19 pandemic

During the pandemic, schools in Wales were required to close for two periods between March and June 2020 and December 2020 and April 2021. Apart from vulnerable learners and the children of key workers, all other learners remained at home and were taught remotely (Welsh Government Policy and Strategy, 2021). The COVID-19 pandemic presented unparalleled challenges for schools and learners. In a recent comprehensive review of the literature on young learners during the pandemic in England (Howard, Khan & Lockyer, 2021), the authors concluded that: '...the quantity and quality of teaching and learning declined during the pandemic, most learners appear to have experienced learning losses, with deprived learners and schools serving more deprived regions having suffered disproportionately.'

In Wales, research on the impact of the COVID-19 pandemic showed there were both challenges and opportunities experienced by learners and their families during the school closures. A key challenge for most learners was learning in the home environment. Examples of common barriers for home learning included disruptions in the home environment such as noise, lack of quiet study space, access to remote learning resources including appropriate hardware, internet connectivity, and inadequate parental/carer support

with schoolwork (Waters-Davies et al., 2021; Department for Education, 2022). There were variations in the degree of challenges experienced by learners. Some learners with higher levels of parental guidance and support, including greater confidence in undertaking independent learning, made greater gains and were able to progress more easily despite the COVID-19 circumstances.

In Wales, there has been some research surrounding the influence of the pandemic on the independent study practice of learners in secondary and further education settings such as sixth forms and colleges (Mylona & Heledd, 2021; WISERD, 2020). A survey by Mylona & Heledd (2021) on the effects of the pandemic with learners aged 16 or older showed that learners reported both positive and negative experiences of their home learning and their experiences of using online study resources. A similar survey with secondary school learners found most learners reported spending between 6 to 10 hours a week completing schoolwork at home (WISERD, 2020). The most common study resource learners reported using was the BBC Bitesize website. In contrast the Welsh Government's Hwb platform and the Oak National Academy (developed by teachers in response to the pandemic) were the least used online learning platforms as reported by learners. None of these previous studies investigated *how* learners used online study resources to support their learning. There is no published research describing what learning strategies learners might have used whilst studying independently during the pandemic, nor is there any research assessing secondary school learners' confidence in using digital learning platforms. The current study aims to close this knowledge gap.

Given the complexity and uniqueness of learning experiences and learning losses during the COVID-19 pandemic, policy responses to help learners 'catch-up' require a variety of evidence-informed strategies and approaches. This has important implications for Welsh Government's Renew and Reform plan, including learning recovery programmes within schools and colleges. The use of effective learning strategies for independent learning including independent study and revision plays an important role in helping learners in secondary schools 'catch-up' and prepare for external examinations.

1.2 Research aims

The aim of the current study is to explore the influence of the pandemic on the independent study practice of school learners aged 14–15 and 16–17 years in Wales. This information will help us to understand whether there is a need for schools to develop further guidance to improve learners' independent study skills to help them 'catch-up' and/or to enable them to make more effective use of their independent study and revision time in preparation for examinations.

1.3 Research questions

The research questions are arranged on the key aspects identified on learners' independent study practice, including use and understanding of learning strategies and study resources, time spent on schoolwork and independent study, confidence towards independent study activities and use of digital learning platforms as well as how schools support learners with independent work. The research questions for this study were as follows:

Q1. Which study resources did learners use for independent work during the COVID-19 school closures and afterwards?

Q2. Which learning strategies did learners use whilst accessing various study resources to support their independent work?

Q3. What influence did the pandemic have on learners' understanding of the effectiveness of learning strategies and study resources?

Q4. What influence did the pandemic have on learners' knowledge of the benefits of some commonly used and more versatile learning strategies?

Q5. How much time did learners invest towards schoolwork and independent study?

Q6. What influence did the COVID-19 pandemic have on learners' confidence in using digital learning platforms?

Q7. What influence did the COVID-19 pandemic have on learners' confidence towards independent learning?

Q8. Where does learners' knowledge of learning strategies come from?

Q9. How helpful was the support from schools with home learning?

Q10. Is there a demand for information about evidence-informed learning strategies and/or study resources?

1.4 Structure of this report

In Section 2 we provide contextual information on the focus of the current report, a review of the existing literature on the independent study habits of school learners' pre-pandemic and during the pandemic.

In Section 3 we describe the research methodology used in this study, including the sampling strategy we used, and the ERaSSQ survey questionnaire completed by learners, to measure learners' independent study practice.

In Section 4 we present the findings of our survey with learners to provide an insight into learners' study practices during the pandemic and at the present time.

In Section 5 we present a discussion of our survey findings with learners and provide recommendations for policy makers.

In this report we use the term independent study practice and independent work interchangeably to refer to schoolwork, study and revision learners completed on their own during the COVID-19 pandemic school closures and afterwards. The overarching terms include school work, independent study and revision, except when the focus is on one of these aspects and not all then we use that term.

2. Literature Review

Acquiring independent learning skills is an important developmental milestone that enables students to be more independent lifelong learners. A recommendation proposed from the findings of the research studies on the impact of the COVID-19 pandemic on the Welsh Education System for 2020 was that the new curriculum should consider the importance of independent learning (Welsh Government The National Strategy for Education Research and Enquiry, July 2021). An important aspect of independent practice includes the learning strategies learners use during independent study. Research suggests the learning strategies learners use during independent study are related to the outcomes they achieve (Bartozewski & Gurung, 2015; Gurung, Weidert & Jeske, 2010; Hartwig & Dunlosky, 2011; Rodriquez, Rivas, Matsumura, Warschauer & Sato, 2018). Learning strategies are the activities learners undertake for their independent work, in other words, *how* they go about learning key content and ideas on their own outside of the classroom (Oakes & Griffin, 2016).

Research suggests that two strategies, retrieval practice and spaced practice, are more effective in helping learners achieve educational outcomes (Agarwal, Nunes & Blunt, 2021; Dunlosky et al., 2013; Karpicke & Roediger, 2006). Dunlosky et al. (2013) evaluated retrieval practice and spaced practice alongside eight other commonly used learning strategies (and arranged these into low, medium and higher utility categories) according to their effectiveness for enhancing learning based on how effectively the strategies can be used across a range of learning tasks and situations. Of the ten learning strategies, two strategies were identified as high utility (retrieval practice and distributed practice [note that we use the term spaced practice here]), three strategies were identified as having moderate utility (interleaved practice, elaborative interrogation and self-explanation), and five strategies were identified as having low utility (summarising, highlighting [or underlining], using keyword mnemonics, imagery use for text learning and repeatedly reading information). These findings have important implications for learning and teaching and for learners' independent study skills.

In this research study we focused on the evaluation of six of the learning strategies described by Dunlosky et al. (2013) as well as five other commonly used learning strategies identified in the literature on learners' study practice. Table 1 presents the learning strategies included in this study and a description of the learning strategies.

Table 1. *Overview of commonly used learning strategies evaluated in the current study^a*

Learning strategy	Description
Highlighting or underlining information/text	To mark out important content (i.e., key words, text) of the to be learned material with a bright/different colour while reading
Reading information/notes over and over	Reading information over and over
Making notes and/or summarising information	Writing notes/summaries (of various lengths) of the information to be learned

Learning strategy	Description
Spaced practice	Implementing a schedule of study/revision practice where study time is separated into multiple sessions overtime. Reviewing learning materials studied earlier in later sessions
Retrieval practice	Retrieving information from memory in absence of the information to be remembered by using practice tests, past papers, quizzes, flashcards (or any other activity which involves actively retrieving information from memory)
Interleaved practice	Mixing study of different, related topics, concepts or problems. Implementing a schedule of study practice that mixes different kind of skills, subjects or topics within a single study session
Elaborate encoding	Connecting what you are trying to learn to what you already know (e.g., using mnemonics). Making connections between information to be learned and other information.
Using mind maps	Writing down a key topic, and from this creating links composed of keywords, phrases, concepts, facts and figures. Mind maps are typically presented as diagrams.
Using flashcards	Writing key terms, facts or to be learned information on small cards. Flashcards are typically two-sided with the prompt / question appearing on one side and the information about the prompt / answer on the other).
Watching videos on the subject topic ^b	Watching videos related to the subject topic on
Listening to audio on the subject topic ^c	Listening to audio related to the subject topic

Note. ^aThis study assessed the use of six learning strategies evaluated by Dunlosky et al. (2013). In the current study, five additional learning strategies identified in the literature on learners' study habits were also included (elaborate encoding, using mind maps, using flashcards, watching video on the subject topic, listening to audio on the subject topic).

^{b, c}These two strategies were identified from our earlier survey with school learners use of independent study practice (Sultana et al., 2023).

2.1 Effective learning strategies

Retrieval practice is a learning strategy based on retrieving information from memory (i.e., practising recall) in absence of the information to be learnt. The process of retrieval strengthens the memory for that information, leading to enhanced long-term learning and improved recall of information (Bjork & Bjork, 2011; Roediger & Karpicke, 2006). Retrieval practice is also referred to as the 'testing effect'. This describes the finding that being tested on information can result in better recall of the information (Roediger & Karpicke, 2006). Examples of retrieval practice activities include completing quizzes, class tests, past paper exam questions, using flashcards, writing notes from memory. The key feature in all retrieval activities is that information is actively recalled from memory and not passively re-read.

Survey studies with university and secondary learners have shown that learners were using retrieval practice activities for independent study. However, learners were using this strategy less frequently compared to suboptimal strategies and not in a way that facilitates learning (Agarwal et al., 2014; Bartozewski & Gurung, 2015; Biwer, Egbrink, Aalten & de Bruin, 2020; Blasiman, Dunlosky & Rawson, 2017; Dirkx et al., 2019; Gurung et al., 2010; Hartwig & Dunlosky, 2011; Karpicke et al., 2009; Kornell & Bjork, 2007; McAndrew, Kamboj & Pierre, 2015; McAndrew, Morrow, Atiyeh & Pierre, 2016; Peña, Knecht & Gavaza, 2021; Piza, 2018; Rodriguez et al., 2018; Susser & McCabe, 2013; Morehead, Rhodes & DeLozier, 2016). Survey results revealed that learners primarily use retrieval practice as a diagnostic tool to evaluate their learning, rather than as a method to actually *learn* information (Hartwig & Dunlosky, 2012; Kornell & Bjork, 2007; Kornell & Son, 2009; McAndrew et al., 2016; McCabe, 2011; Morehead et al., 2016; Piza, 2018; Schmidmaier et al., 2011). One of the reasons that learners use retrieval practice as a diagnostic tool might be because many will be familiar with their experience of completing quizzes, class tests, to find out how well they have learnt information and teachers using class tests, past paper questions to find out how well the information has been learnt.

This study aims to assess how learners might have used retrieval practice to complete independent work during the school closures, and to update our knowledge on how learners identify this effective learning strategy. Information on learners' use and understanding of effective learning strategies for study can provide insight and understanding on how learners use effective learning strategies. In addition, this can provide valuable evidence to inform Welsh Government advice to schools on the most effective strategies to help learners catch up. Retrieval practice can also be used as an effective formative assessment method to help assess learners independent learning to help improve their study skills.

Spaced practice is a learning strategy which involves implementing a schedule of study/revision practice where study time is separated into multiple sessions overtime and reviewing previously learnt information in successive sessions. This can help to slow down the rate of forgetting newly learned information leading to enhanced learning. This learning strategy is underpinned by the forgetting curve (Ebbinghaus, 1885/2006), and has been shown to be effective by subsequent research (Bahrick et al., 1993; Kornell, 2009; Sobel, Cepeda & Kapler, 2011; Kim, Wong-Kee-You, Wiseheart, & Rosenbaum, 2019). Studies with university and secondary school learners have shown that although learners are aware of the spacing advantage, they reported using spaced practice less frequently compared to more suboptimal learning strategies such as repeated reading (Dirkx et al., 2019; Susser & McCabe, 2013; Sultana et al., 2023). The inconsistency between learners' knowledge and utilisation of spaced learning may be partly to do with the lack of knowledge about the

learning advantage of spaced practice. Another explanation for this is that it is a strategy that advises on *when* rather than *how* to practise and is therefore less likely to be viewed as a practical learning strategy in its own right. The current study aims to assess learners' use of spaced practice for independent learning during the school closures as well as learners' awareness of the spacing advantage.

2.2 Use and understanding of learning strategies

Previous research on learners' study practice in university and secondary school settings has shown that learners predominantly use less optimal learning strategies such as repeated reading approaches, highlighting [or underlining] information and summarising information, compared to more effective learning strategies such as retrieval and spaced practice and have inaccurate and/or incomplete understanding about the effectiveness of the learning strategies they use (Agarwal et al., 2014; Bartozewski & Gurung, 2015; Biwer, Egbrink, Aalten & de Bruin, 2020; Blasiman, Dunlosky & Rawson, 2017; Dirkx et al., 2019; Gurung et al., 2010; Hartwig & Dunlosky, 2011; Karpicke et al., 2009; Kornell & Bjork, 2007; McAndrew, Kamboj & Pierre, 2015; McAndrew, Morrow, Atiyeh & Pierre, 2016; Peña, Knecht & Gavaza, 2021; Piza, 2018; Rodriguez et al., 2018; Schmidmaier et al., 2011; Susser & McCabe, 2013; Morehead, Rhodes & DeLozier, 2016). The current authors conducted a similar survey study with learners aged 14–15 years in secondary schools in North Wales and found similar results (Sultana et al., 2023). The findings are in line with those of previous studies mentioned above. The findings reflect what is found in the earlier studies mentioned above on learners' study habits which showed that learners rarely make use of effective learning strategies.

Learners typically use learning strategies to study and/or revise in preparation for assessments and exams. During the school closures caused by the COVID-19 pandemic most learners were completing schoolwork on their own whilst at home. Given the change in the delivery of schoolwork as well as the increased autonomy on learners to undertake independent work during the pandemic, it is important to investigate any change in learners' independent study habits. Existing studies into the impact of the pandemic with learners in secondary and further education settings explored the learning experiences of home learning and using study resources and there remains an absence of research on learners' use and understanding of learning strategies (WISERD, 2020; Mylona & Heledd, 2021). There is no published research describing what learning strategies young learners might have used to study whilst studying at home during the pandemic, nor is there any research evaluating to what extent secondary learners study practice has been influenced by the pandemic. This research aims to close this gap by gathering evidence on how learners use learning strategies and the influence of the COVID-19 pandemic. This will provide valuable evidence for Welsh Government, schools, and school improvement professionals as they design post-pandemic support.

2.3 Other key aspects of independent study

There are other key aspects of independent study practice such as investing effort, including time, for independent study and revision, confidence towards using digital learning platforms, confidence towards independent learning skills and learners source of information on learning strategies (Oakes & Griffin, 2016). Oakes and Griffin (2016) proposed one way to encourage high levels of effort is to communicate how many hours a week learners should consider investing for independent study. A combination of these

aspects is important for independent work. In addition to investigating *what* learning strategies and study resources learners use we also examined 'why' learners might rely on lower utility strategies. In the current study we also examined where learners' knowledge about learning strategies and resources came from, the time invested towards independent study, and how confident learners felt about independent study and using digital learning platforms. Over the years the notion that learners have different learning styles has become widespread within the education field, however in an important review of the literature on learning styles by Pashler, McDaniel, Rohrer and Bjork (2008) the authors concluded that there was no robust scientific evidence to support the learning style theory. More recent research also showed that there was a lack of evidence to support that learners learn better when instruction is tailored to their learning styles (Nancekivell, Shah & Gelman, 2019). For this reason, in the current study with school learners, we did not investigate different learning styles.

The current study also uses a sampling method that differs significantly from that of earlier studies. There have been no studies of this nature that have used probability sampling methodologies to explore the influence of the pandemic on secondary age learners. The present study used a random sampling method to obtain a representative sample of learners aged 14–15 and 16–17 years in secondary schools in Wales.

3. Methodology

3.1 Research design

In this research study we used a cross-sectional survey. This study was conducted as part of other Bangor University led CEN school research projects where schools in Wales were sampled and invited to participate. Schools for the current study were subselected from a larger sample required for other Bangor University CEN projects. The study population for the current study was school learners in Year group 10 and Year group 12, and in the other CEN projects the study populations included school teachers and parents/carers. There was no interest in Year 10 and Year 12 learners in the other CEN projects, therefore, learners did not receive multiple questionnaires from different projects.

3.2 Sample description

The target population for the current study was defined as learners aged between 14 and 15 years (school Year group 10) and 16 and 17 years (school Year group 12) studying GCSE and A Level qualifications in mainstream middle and secondary schools in Wales.

A multistage clustered sample design was used for a sample selection. There were two stages to the sampling procedure. This sampling approach was taken as learners are registered in schools and to obtain a sample of school learners we had to first invite a sample of schools. An advantage of cluster sampling includes lower cost and lower effort for the same effective sample size, that is the same level of confidence intervals, compared with a simple random sample (Kish, 1995). The sample selection followed all the steps for selecting a probability sample in order to represent a population as described by Kish on survey sampling (Kish, 1995).

At the first stage of the sampling process, secondary schools were selected from a list ordered by local authority (Blaenau Gwent, Bridgend, Caerphilly, Cardiff, Carmarthenshire, Ceredigion, Conwy, Denbighshire, Flintshire, Gwynedd, Isle of Anglesey, Merthyr Tydfil, Monmouthshire, Neath Port Talbot, Newport, Pembrokeshire, Powys, Rhondda Cynon Taf, Swansea, Vale of Glamorgan, Torfaen and Wrexham), and within region by language medium (dual stream, English medium, English with significant Welsh, Transitional and Welsh medium) and the percentage of learners in schools eligible for free school meals (eFSM) (mean percentage scores) for 2019/21. At the second stage, we invited all learners in Year group 10 and Year group 12 in each of the schools that accepted the survey invite, to complete the Effective Revision and Study Strategies Questionnaire (ERaSSQ). This approach was taken to minimise unnecessary class disruption in schools. A detailed explanation of the ERaSSQ survey is given in sub section 2.4 below titled *survey measure*.

3.3 Survey procedure

We obtained ethical approval for the study from the School of Educational Sciences Research Ethics Committee of Bangor University (ethical approval number: 17022022-1628). The invitation to complete the online questionnaire was sent to headteachers in selected schools in the six regional consortia and partnerships in Wales in March 2022 (these are GwE, EAS, Mid Wales Partnership, CSC, Neath Port Talbot, Partneriaeth). Schools were invited to attend information sessions in March and April 2022 to explain the purpose of the surveys in more detail. Finally, a follow-up reminder email was sent to schools in May 2022 by the regional consortia and partnerships and emphasised that the CEN research officers would be contacting schools with a courtesy follow-up reminder

phone call. Between May and June 2022, a final follow-up phone call was made to the schools to encourage head teachers to engage with the CEN surveys.

Once a school accepted the CEN project invite, the survey link for the Effective Revision and Study Strategies Questionnaire was sent to the school headteacher and/or nominated member of staff to forward on to all learners in Year group 10 and Year group 12 to complete. The survey was available in both Welsh and English.

Study information was sent to the school headteachers. This informed the school headteacher about their learners' participation in the survey. In the first page of the survey, we provided a written introduction that explained the purpose of the research study and explained how the survey could be completed. We emphasised that learners' answers would be treated confidentially, that there were no 'right' or 'wrong' answers, and that their responses would not reflect on their current performance in school or that of their school. The learners were given the opportunity to consider their participation in the survey, opt-out or provide consent prior to completing the questionnaire. The online questionnaire was completed by learners on their own in school. Completion of the questionnaire required approximately 20 minutes. Learners were thanked for their assistance and given a written debrief about the study. Neither learners nor schools were remunerated for their participation in the survey.

The school invitation letters and reminders were undertaken as part of other Bangor University CEN school projects where the headteachers of the selected schools were invited to other CEN projects. Schools for the current study were subselected from a larger sample required for other Bangor University CEN projects. The study population for the current study was school learners in Year group 10 and Year group 12, and in the other CEN projects the study populations included school teachers, parents/carers. There was no interest in Year 10 and Year 12 learners in the other CEN projects, therefore, learners did not receive multiple questionnaires from different projects. We used the same procedure to contact the schools for all the Bangor University CEN studies and one email invitation letter was sent via the regional consortia and partnerships containing an invitation for schools to the CEN studies, instead of multiple emails being sent on the individual CEN projects. This meant multiple emails were not sent to the headteachers of the selected schools. This approach was taken to minimise the number of invitations school headteachers were sent and thus to help the survey response rate. In total, seven schools accepted the survey invite. This represents a response rate of 22% at the school level. Of the participating schools, responses from 74 learners were obtained.

3.4 Survey measure

We used the ERaSSQ survey to measure learners' study practice for independent work including, schoolwork, study and/or revision from the start of the COVID-19 pandemic until the study end date (May 2022). The survey was developed using the Online Surveys programme (<https://www.onlinesurveys.ac.uk/>). The ERaSSQ survey was developed by the current authors to answer research questions as part of a PhD thesis evaluating the use of evidence-informed learning strategies for improving secondary school learners' independent study practice (Sultana, 2023). To inform the development of the survey items, key aspects of learners' independent study practice were identified following a review of the literature (Blasiman et al., 2017; Dunlosky et al., 2013; Kornell and Bjork, 2007; Oakes & Griffin, 2016). These included school learners use and understanding of learning strategies, effort towards independent work, and school-based support with study/revision. There are 18 survey items that use a closed-ended (Likert scale, multiple choice) and open-ended format.

The ERaSSQ survey has previously been used for a regional survey with 385 secondary school learners in North Wales (Sultana et al., 2023). The aim of the regional survey was a scoping exercise to explore secondary school learners use and understanding of evidence-informed learning strategies and more broadly their independent study practice. In addition, the evidence we collated have been used to develop a learning programme called the Improving Standards through Effective Revision (iStER) programme, for improving secondary learners independent study practice.¹ The findings from the regional survey has been submitted to the School of Human and Behavioural Sciences, Bangor University in partial fulfilment for the degree of Doctor of Philosophy, and is being prepared to submit for publication in an academic journal.

For the present study, we used a modified version of the ERaSSQ survey with learners in Year group 10 and Year group 12. The ERaSSQ has been modified following peer review in an academic journal and to reflect appropriate changes in learners' education that relate to the COVID-19 pandemic. The modified version of the ERaSSQ contains new survey items designed to measure secondary school learners use and understanding of learning strategies as well as *study resources*, effort towards *independent schoolwork* and study, *where learners' knowledge of learning strategies and study resources come from*, *confidence in using digital learning platforms* and in their *independent study skills* and how *schools supported learners with independent work*. Minor modifications were also made to the wording of the survey items such as learning strategy terms, response options as well as the addition of new learning strategies following findings in our previous regional survey with school learners. The changes that were made to the ERaSSQ survey for the current study are presented in Table B.1 (see Appendix B).

The survey items in the ERaSSQ relate to the current research questions outlined in the introduction section. The survey items for the modified version of the ERaSSQ in this study were as follows:

Use and understanding of learning strategies and learning resources. The first section of the survey asked learners about the learning strategies and study resources used from the start of the COVID-19 pandemic until May 2022. To measure the use of study resources, we asked learners to rate how often they used the twelve common study resources on a 5-point Likert scale from never (1) to always (5) (see Appendix A). We also gave learners the opportunity to write down any additional study resources. We then asked learners to indicate whether they used any of the common learning strategies whilst accessing any of the twelve study resources listed in the survey question. We also gave learners the opportunity to indicate if they did not use any of the learning strategies whilst accessing any of the study resources.

To measure learners' understanding of the effectiveness of common learning strategies, we asked learners to rate the eleven learning strategies on how effective they believed the strategies to be on a 5-point Likert scale from not at all helpful (1) to extremely helpful (5). We also asked learners to rate how effective they believed the twelve study resources to be on a 5-point Likert scale from not at all helpful (1) to extremely helpful (5). The option of 'I am not sure' was also included in these questions.

¹ The findings from the ERaSSQ have been used by the Regional School Effectiveness and Improvement Service for North Wales (GwE) to support PhD studentship research to develop a learning programme called the Improving Standards through Effective Revision (iStER) programme. The findings from the regional survey has been submitted to the School of Human and Behavioural Sciences, Bangor University in partial fulfilment for the degree of Doctor of Philosophy, and is being prepared to submit for publication in a journal.

To measure knowledge of the benefit of retrieval practice, we asked learners to choose one option out of multiple alternatives that best indicated how they would practise to prepare for a forthcoming examination. Using the same question style, we also measured knowledge of the spacing advantage, using flashcards and using mind maps to study/revise. To measure awareness of the spacing advantage in a different way, we asked learners to choose one response option from a choice of three response options on spacing practice presented to them, the learning strategy which they think research has found to be effective for learning (informed by Susser and McCabe, 2013). If learners indicated that studying the material in multiple sessions of shorter duration is the method that research has found to be effective for long-term retention, then we would infer learners understand there is an advantage to spaced study.

Effort towards schoolwork and independent study (i.e., time spent on schoolwork and independent study). To measure effort towards schoolwork (i.e., time spent on schoolwork), we asked learners how many hours of schoolwork they did whilst at home during the COVID-19 school closure. To measure effort towards independent study (i.e., time spent on independent study), we asked learners how many hours of independent study they did whilst at home during the COVID-19 school closure.

Confidence levels on using digital learning platforms. To measure learners' confidence in using digital learning platforms at the start of the COVID-19 school closures, we asked learners to rate how confident they felt using the common digital learning platforms on a 5-point Likert scale from not confident at all (1) to extremely confident (5). We also asked learners to rate how confident they now felt about using the common digital learning platforms on a 5-point Likert scale from not confident at all (1) to extremely confident (5). Learners could also write down any additional digital learning platform not listed in the survey question and rate how confident their initial and current confidence of using the platform they had noted on a 5-point Likert scale from not confident at all (1) to extremely confident (5). We also gave learners the option of 'Our school/We did not use this' to indicate platforms they had not used.

Confidence levels on independent study skills. To measure learners' confidence in their independent study skills at the start of the COVID-19 school closures, we asked learners to rate how confident they felt about independent study skills and learning activities on a 5-point Likert scale from not confident at all (1) to extremely confident (5). We also asked learners to rate how confident they now felt about the independent study skills and activities on a 5-point Likert scale from not confident at all (1) to extremely confident (5). These study skills and learning activities were: *learning on their own without help from teacher(s), using online learning resources, using the internet for finding effective learning resources, using effective learning strategies, using the internet for finding effective learning strategies, using offline learning resources, independent study, and independent revision.*

Knowledge of learning strategies and study resources. To measure where learners' knowledge about learning strategies and study resources come from, we asked learners to select all relevant listed sources. There were seven options relating to the source of learning strategies and study resources. These were: *school teacher(s), school study/revision tutor, school study/revision support centre, parents/carers, friend(s)/peers, online, and private tutor(s).*

Getting support from schools. To measure support with home learning relating to the COVID-19 pandemic, including using digital communication and learning platforms, we asked learners to rate how helpful the support they received from schools was on a 5-point scale from not at all helpful (1) to extremely helpful (5).

3.5 Statistical analysis

We used post-stratification techniques to adjust for survey non-response by matching the responding dataset to the school population data set for the number of learners in Year 10 and Year 12. Our analysis therefore reflects the number of learners population distribution. In addition, any variables that are related to the number of learners also are corrected for non-response to the extent that they are related to the number of learners, such that the potential non-response bias related to the number of learners is eliminated fully after post-stratification. The population data on total year group numbers were obtained from the sample frame. We obtained the contextual school data for 2021/22 from Welsh Government Statistics for Wales. We could not correct for clustering, due to confidentiality reasons school names were not collected. This was to ensure learners' responses could not be linked back to the schools. Any clustering effect is expected to be low due to the relatively low response rate within schools. Not taking account of clustering in the analysis does not effect the point-estimates, which are still unbiased, however, affects confidence intervals. In such situations the confidence interval is slightly wider than it should be if clustering is accounted for. The effect would be minor considering that due to the low nonresponse the size of the clusters was smaller.

We report the percentage scores for the survey results with learners according to the following categories proposed by Estyn (2022). These are as follows:

- Nearly all = with very few exceptions
- Most = 90% or more
- Many = 70% or more
- A majority = over 60%
- Half = 50%
- Around half = close to 50%
- A minority = below 40%
- Few = below 20%
- Very few = less than 10%

4. Results

This section presents the results of the ERaSSQ survey with school learners. The findings are presented below according to the research questions outlined in the introduction section.

4.1 Which study resources did learners use for independent work during the COVID-19 school closures and afterwards?

We asked learners about the study resources they used for independent work. We asked learners to indicate how often they used the twelve study resources for schoolwork, study and/or revision at home since the start of the COVID-19 pandemic school closures until the present day. Learner ratings of the study resources were made on a 5-point scale from never (1) to always (5). Table 2 shows the twelve study resources and the weighted percentage of learners reporting the various frequencies per study resource, arranged from most to least often used. The study resources that scored most highly as being used were those provided by schools such as information/notes in their class book/folder and information notes uploaded by teacher(s) on the school's digital learning platform. The online study resources that scored most highly as being used were the WJEC website, BBC Bitesize and the Welsh Government's Hwb Platform (Table 2).

Table 2. Weighted percentage scores for learner responses to the survey question, "Since the start of the COVID-19 pandemic until the present day, how often did you use the following learning resources to learn schoolwork, study and/or revise at home?"

Learning resource	Always	Most of the time	Sometimes	Rarely	Never
	% [CI]	% [CI]	% [CI]	% [CI]	% [CI]
Information/notes in class book/folder	35 [24.1, 46.6]	35. [25.0, 47.1]	17 [9.5, 27.5]	7 [3.3, 15.9]	6 [2.5, 14.3]
Information/notes uploaded by teacher(s) on school's digital learning platform	32 [21.6, 43.4]	37 [26.4, 49.0]	18 [10.5, 28.9]	9 [4.1, 17.4]	5 [1.8, 12.8]
WJEC website	16 [8.5, 27.3]	23 [14.2, 34.4]	24 [15.4, 35.5]	17 [9.4, 27.3]	21 [13.0, 2.0]
BBC Bitesize	7 [3.3, 15.9]	20 [12.0, 30.7]	39 [28.0, 50.9]	21 [12.8, 32.4]	13 [7.0, 22.9]

Learning resource	Always	Most of the time	Sometimes	Rarely	Never
	% [CI]	% [CI]	% [CI]	% [CI]	% [CI]
Hwb Platform	17 [9.4, 27.3]	23 [14.2, 34.4]	15 [8.4, 25.9]	16 [8.8, 26.8]	30 [20.1, 41.6]
Text book/guide	19 [10.7, 30.4]	23 [14.6, 34.6]	9 [4.4, 18.8]	13 [7.1, 23.2]	36 [25.3, 47.6]
Quizlet	4 [1.2, 11.3]	4 [1.3, 13.2]	25 [16.3, 36.5]	26 [18.2, 39.3]	39 [28.4, 51.4]
AQA website	3 [0.7, 12.2]	3 [0.6, 9.8]	6 [2.0, 14.5]	8 [3.6, 17.4]	81 [69.4, 88.4]
Tanio.Cymru	1 [0.2, 8.8]	3 [0.6, 9.8]	5 [1.8, 12.9]	6 [2.6, 14.5]	85 [74.9, 91.4]
Khan Academy		2 [0.2, 12.5]	7 [2.5, 17.2]	5 [1.8, 12.9]	86 [75.3, 92.9]
Seneca Learning			1 [0.2, 8.8]	6 [2.6, 14.5]	93 [83.9, 96.7]
Oak National Academy			1 [0.2, 8.8]	4 [1.2, 11.3]	95 [87.1, 98.2]

Note. Learning resources are ordered by frequency of use, from most to least often used.

4.2 Which learning strategies did learners use whilst accessing various study resources to support their independent work?

Next, we asked learners about which learning strategies they were using to support their learning whilst accessing different study resources for independent work. This included six of the learning strategies categorised by Dunlosky et al. (2013) into three groups based on whether they considered them having high, medium or low utility for their effectiveness in enhancing learning. The effectiveness ratings were assigned depending on the strength of the underlying evidence to support their evidence in research. The learning strategies

categorised as 'high' utility were spaced practice and retrieval practice, and the learning strategy categorised as 'moderate' utility and included in the current study was interleaved practice. The learning strategies categorised as 'low' utility were highlighting and/or underlining information, reading information/notes over and over and interleaved practice. Three additional learning strategies identified in the literature were also included (*using flashcards, using mind maps and elaborate encoding*), although we do not include a utility rating for these three strategies because they were not evaluated by Dunlosky et al. (2013). These three strategies are commonly used strategies by learner populations, for this reason, we also explored *whether* learners were might using these strategies.

Figures 1 to 9 show the nine common learning strategies and study resources, and the percentage of learners who reported using the strategies whilst accessing the various study resources for independent work. Our survey results above on learners' use of study resources showed that the most frequently used study resources were information/notes in their class book/folder and information notes uploaded by teacher(s) on the school's digital learning platform (Table 2). Our survey results on which learning strategies learners were using with these most frequently used study resources show that a majority of learners were using the strategies considered to have low support, including highlighting and/or underlining information/text, reading information/notes over and over and making notes and/or summarising information (Figures 2, 4 and 5). In contrast, a minority were using the learning strategies retrieval and spaced practice categorised as having high support whilst accessing these study resources (Figures 6 and 7). Overall, survey results showed learners reported using both less and more effective learning strategies for independent work whilst accessing these frequently used learning resources.

Figure 1 *Percentage of learner responses to the survey question, "Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you **used and/or made your own mind maps** whilst accessing any of these learning resources for schoolwork, study and/revision at home?"*

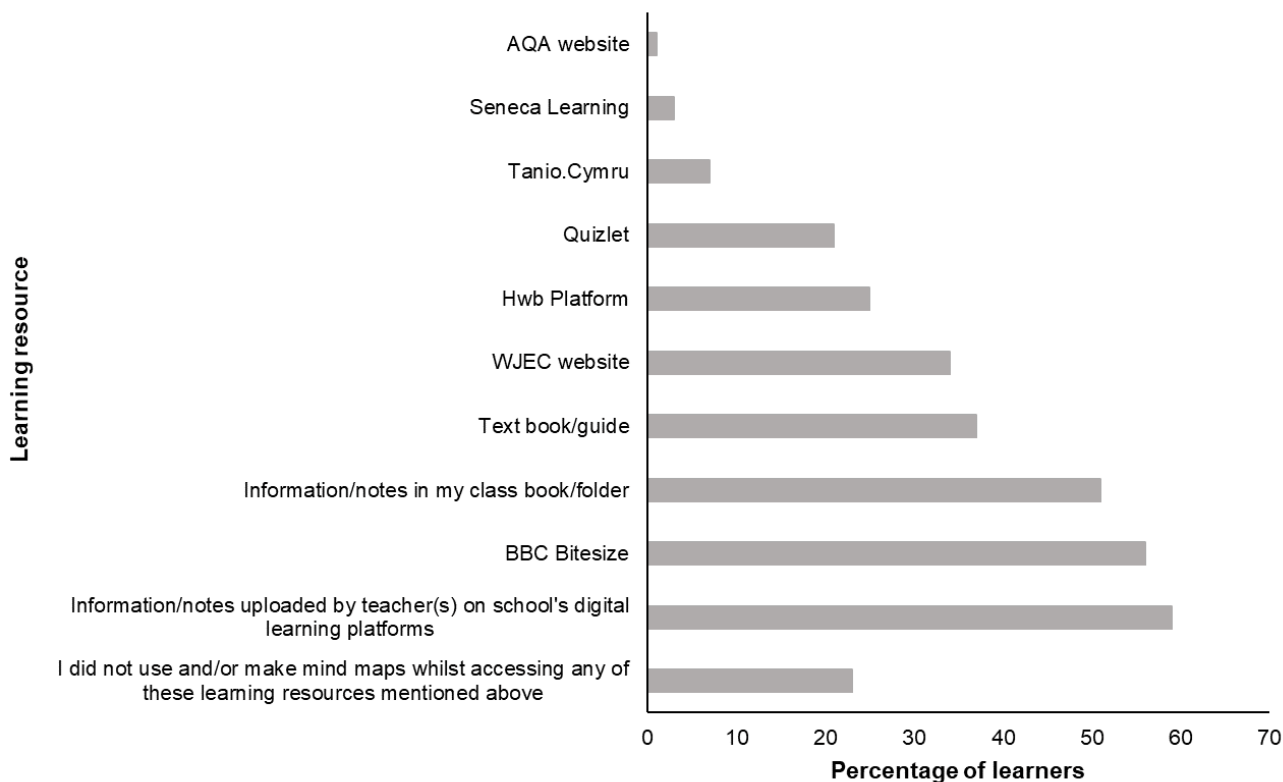


Figure 2 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you **highlighted and/or underlined information/text** whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

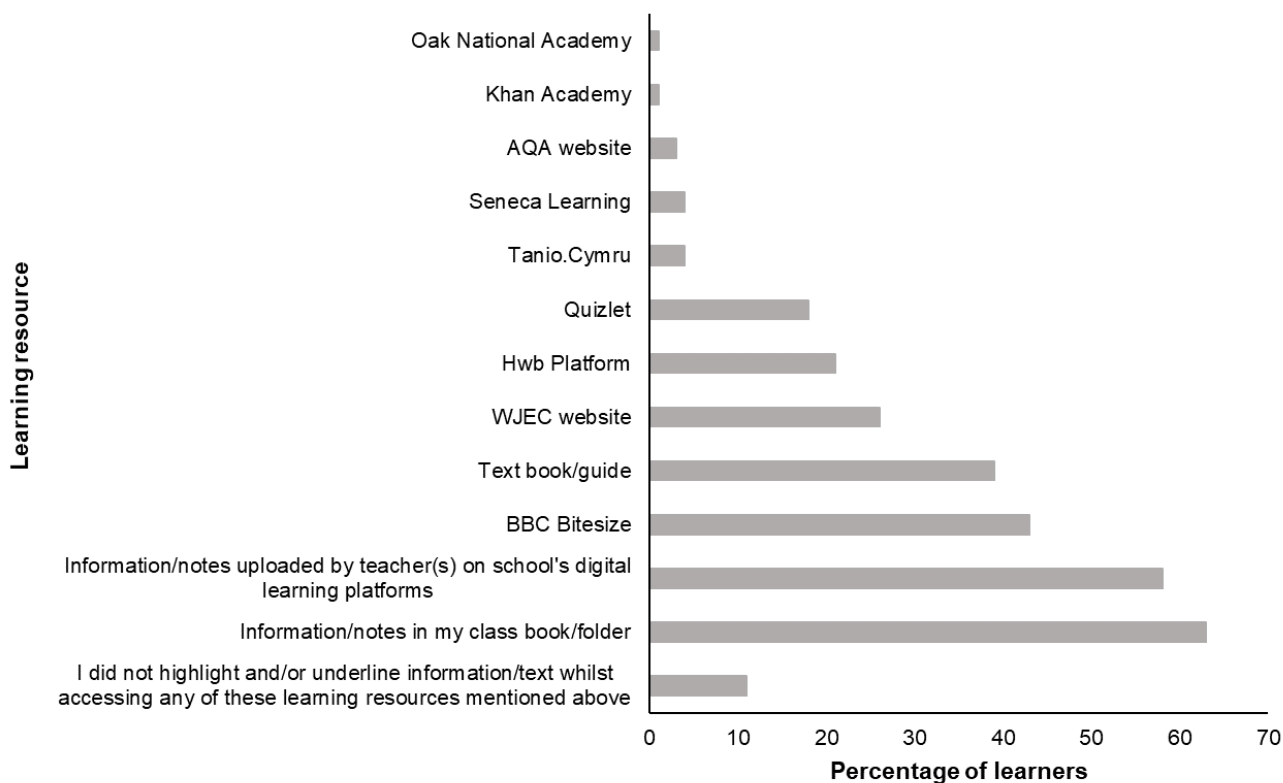


Figure 3 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you **used and/or made your own flashcards** whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

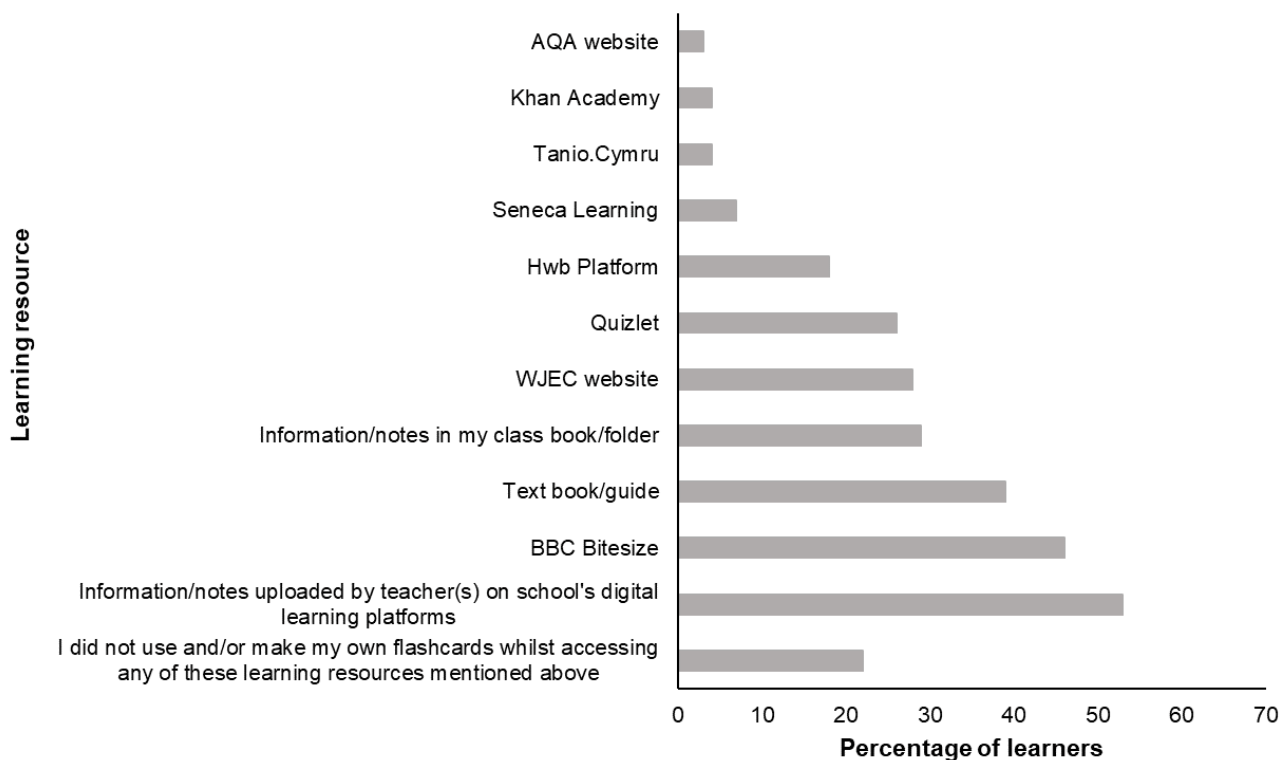


Figure 4 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you **read information/notes over and over** whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

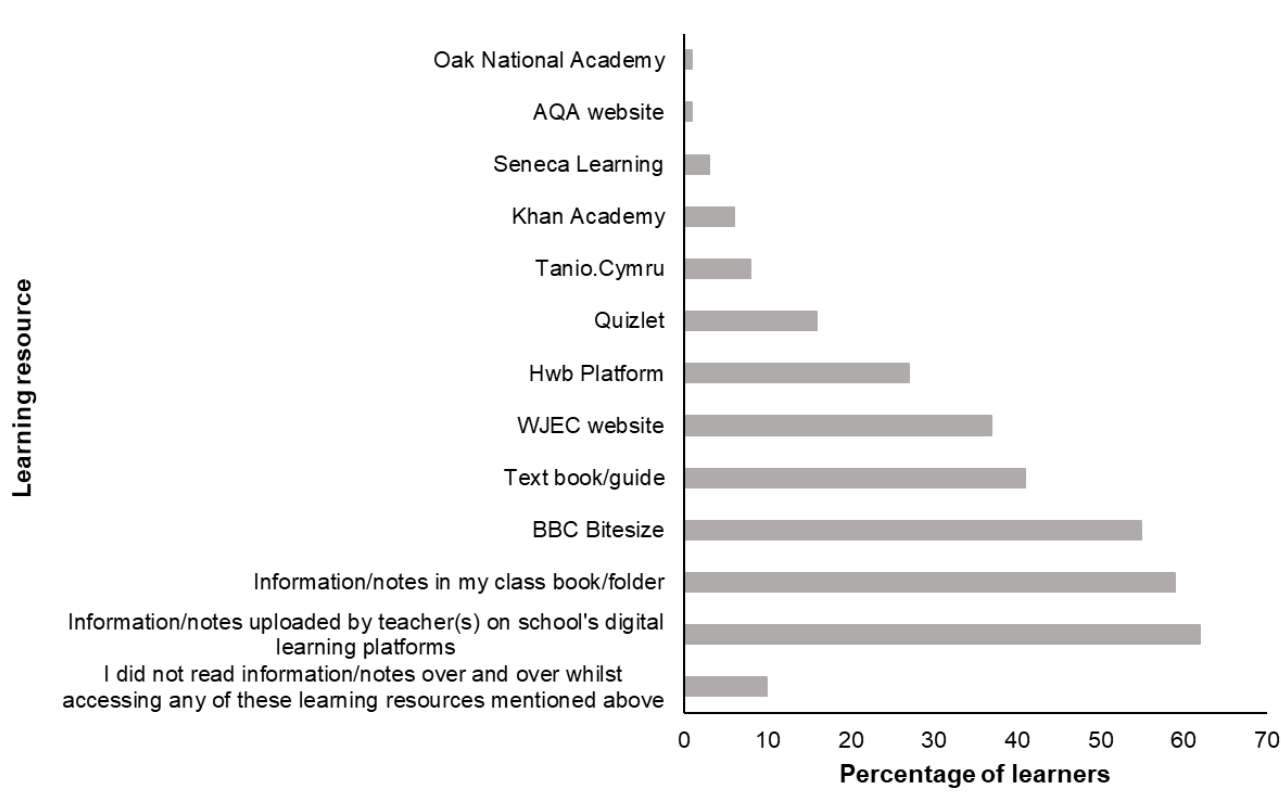


Figure 5 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you **made notes and/or summarised information** whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

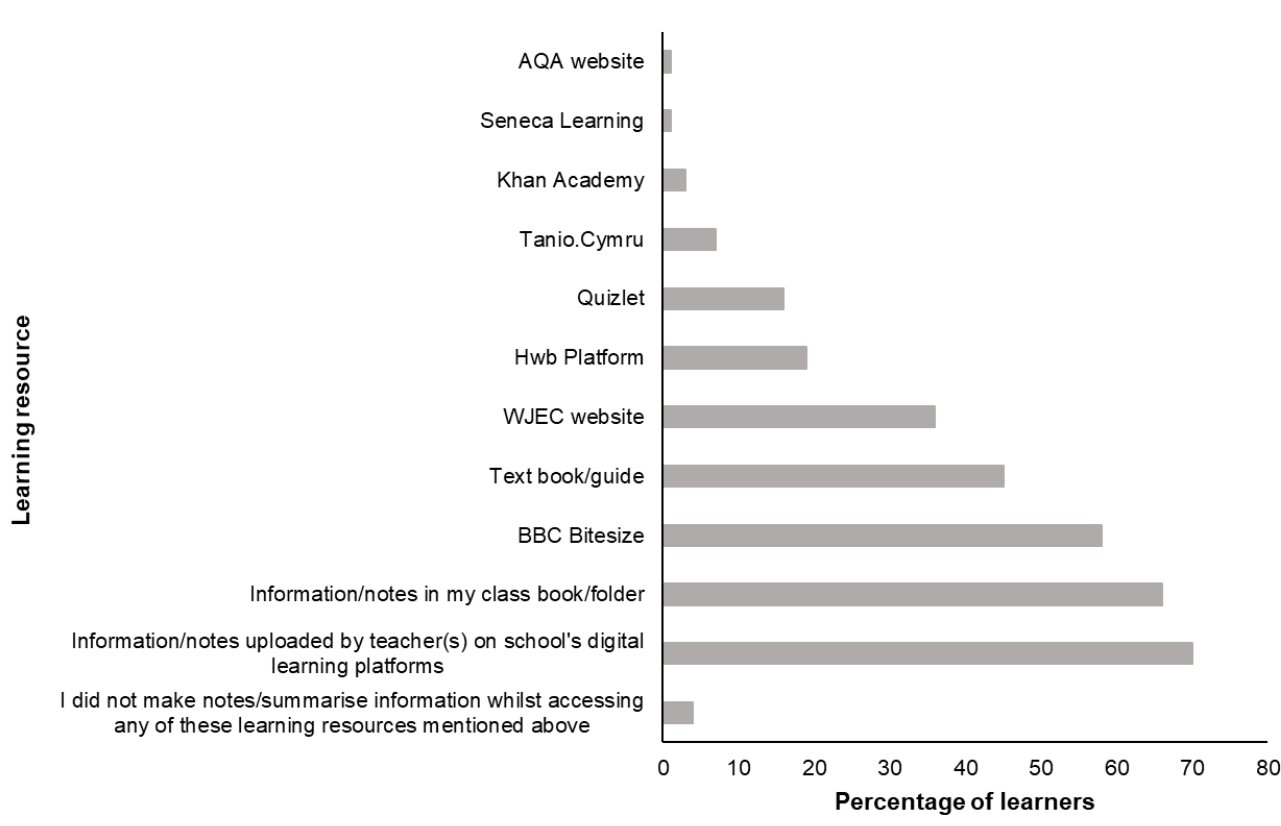


Figure 6 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you used **spaced practice** whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

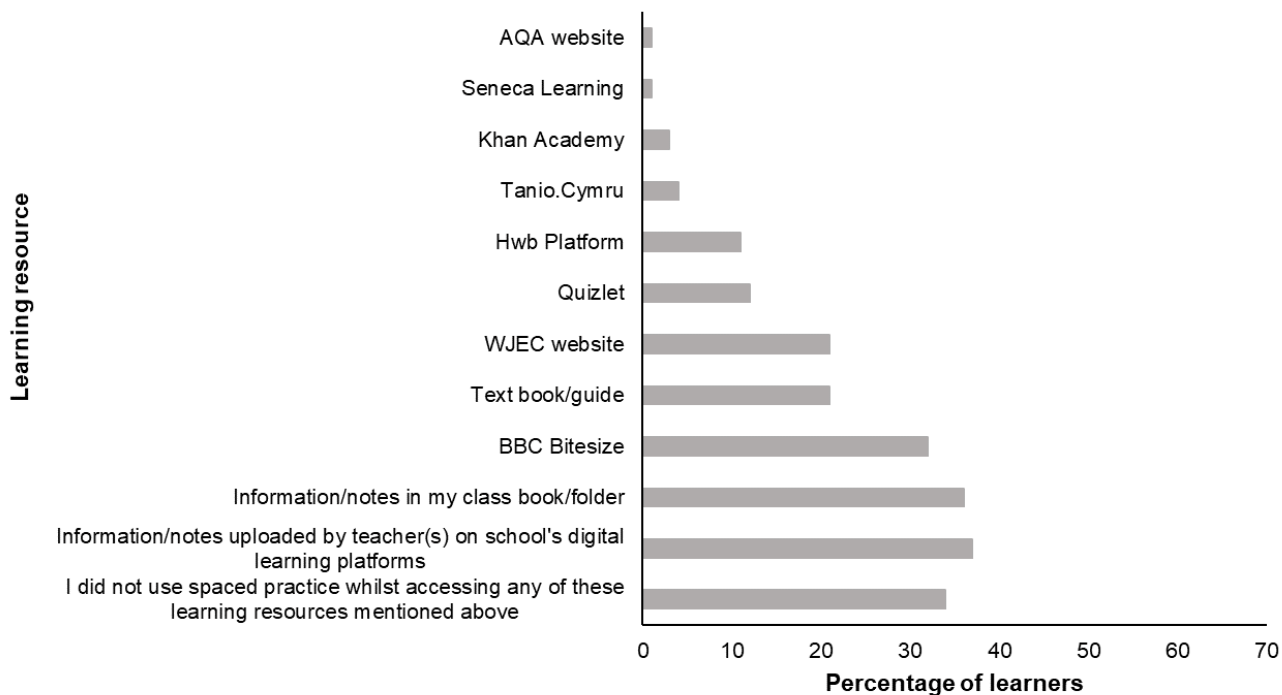


Figure 7 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you used **retrieval practice** whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

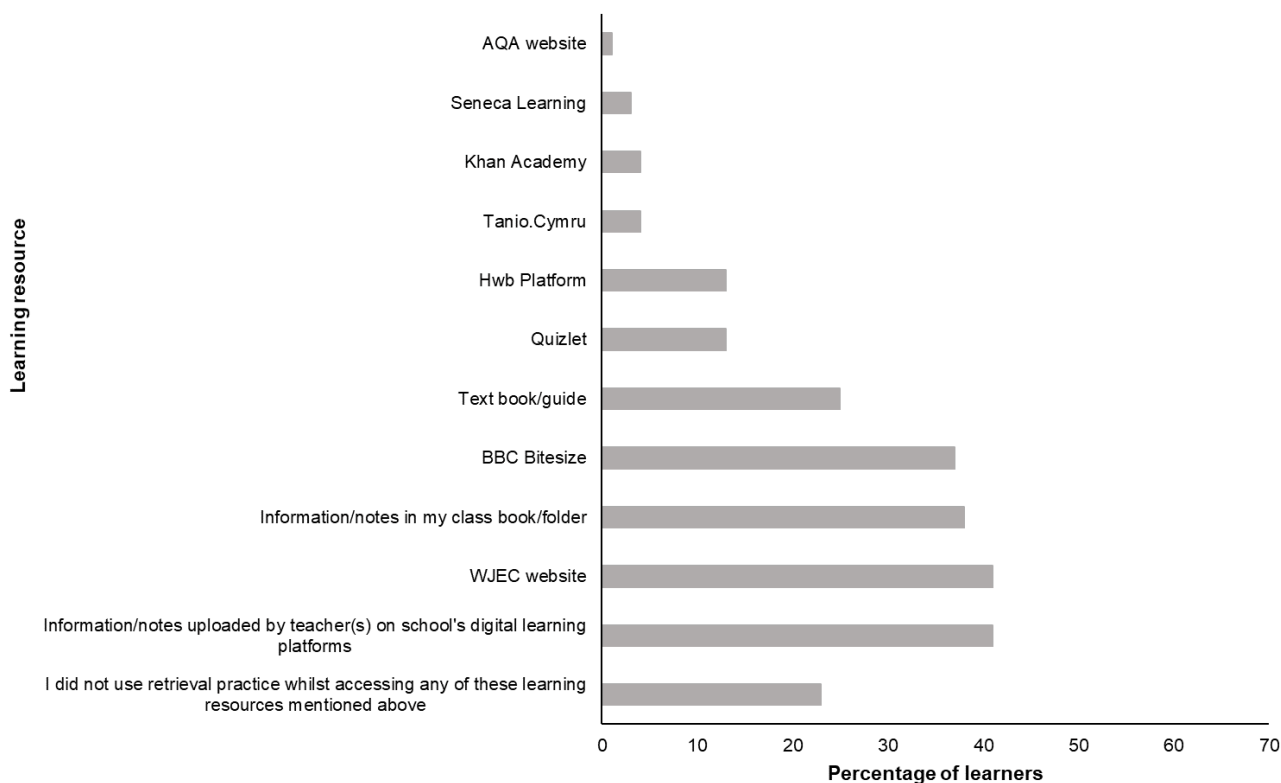


Figure 8 Percentage of learner responses to the survey question, “Since the start of the COVID-19 school pandemic until the present day, for any of the learning resources listed below have you used **interleaved practice** (i.e., organising your study time so that you mix different kinds of problems or topics within a single study session), whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”

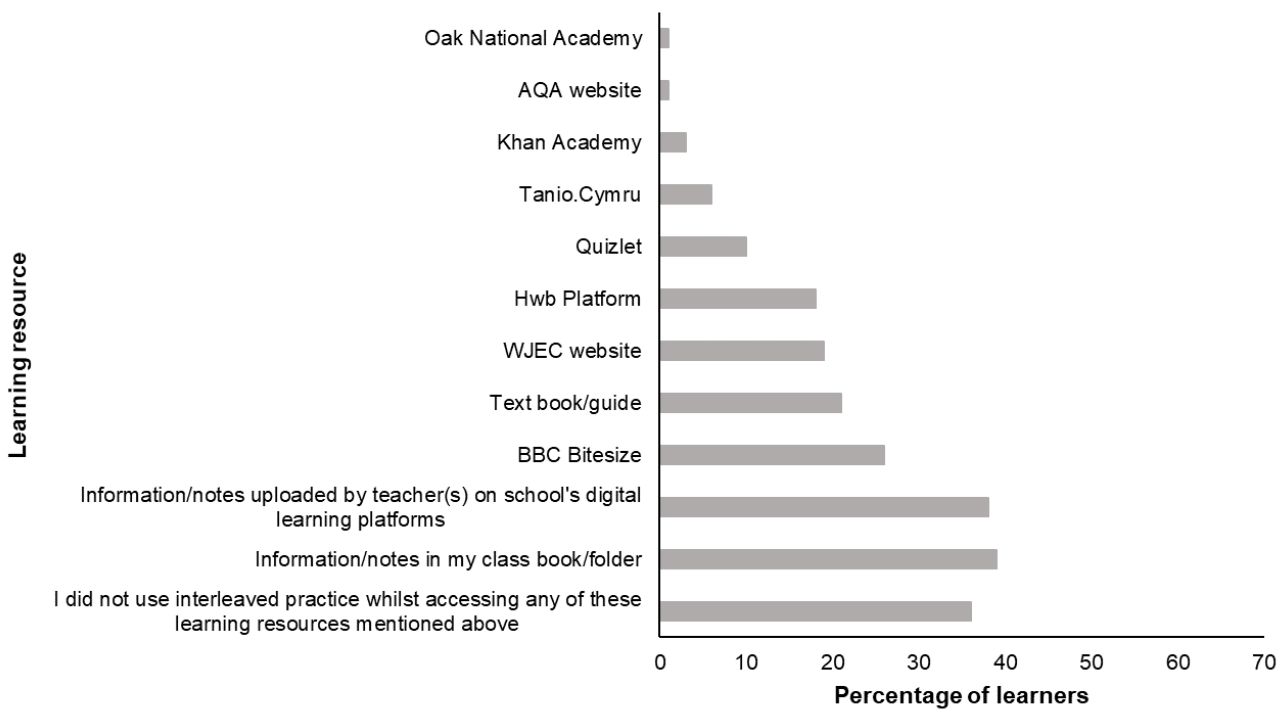
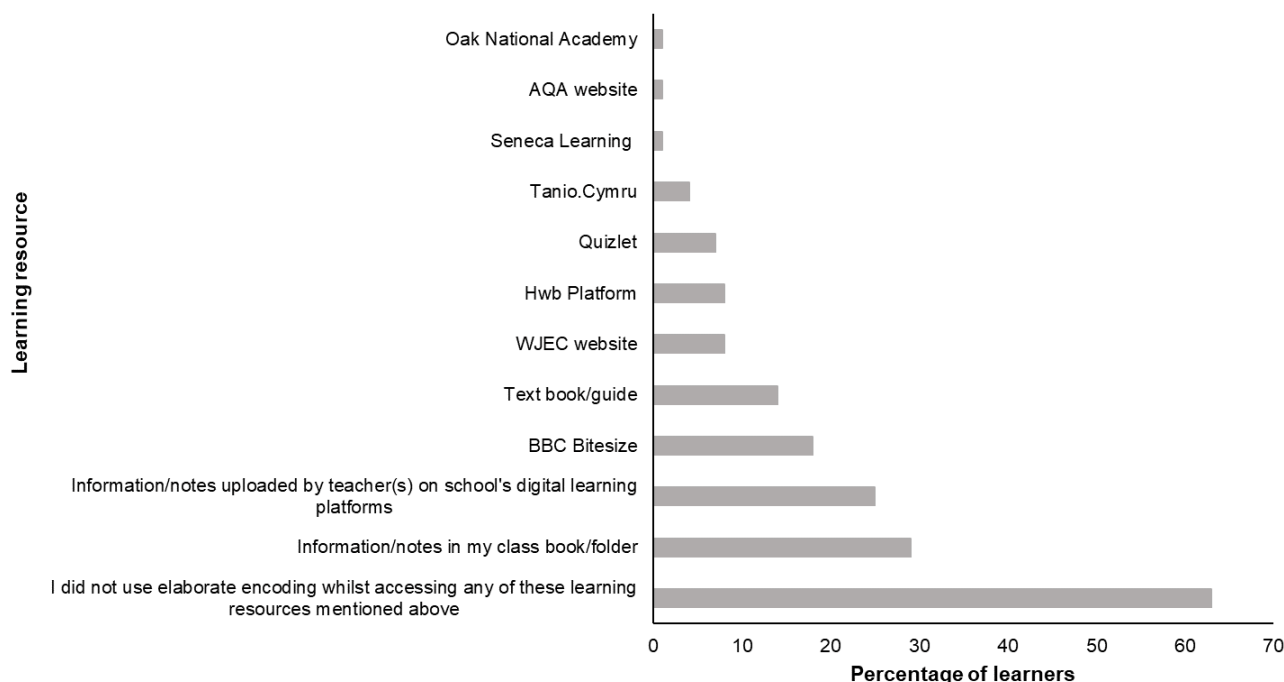


Figure 9 Percentage of learner responses to the survey question, “Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you used **elaborate encoding**, whilst accessing any of these learning resources for schoolwork, study and/or revision at home?”



4.3 What influence did the pandemic have on learners’ understanding of the effectiveness of learning strategies and study resources?

We asked learners about what they understand to be the most and least effective learning strategies for independent work. We asked learners to think about the efficacy of common learning strategies and rank the effectiveness of the strategies for learning schoolwork, study and/or revision (Table 3). We asked learners to rate how effective they thought each strategy was for independent work. Learner ratings of the effectiveness were made on a 5-point scale, from not at all helpful (1) to extremely helpful (5), and the option ‘I am not sure’ was also included in this question. Table 3 shows the eleven learning strategies and the weighted percentage scores for learners’ ratings of strategy effectiveness, arranged from most to least helpful.

The learning strategy that scored most highly as being effective was making notes and/or summarising information, this strategy was categorised as a lower utility strategy by Dunlosky et al. (2013). Retrieval practice, categorised as having higher utility by Dunlosky et al. (2013) for enhancing learning also scored highly as being effective. The survey results indicate that learners do not have an accurate understanding about the effectiveness of some common learning strategies.

Table 3. Weighted percentage scores for learner responses to the survey question, “How effective do you think the following learning strategies are for schoolwork, study and/or revision?”

Learning strategy ^a	I am not sure	Extremely helpful	Very helpful	Moderately helpful	Slightly helpful	Not at all helpful
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Making notes and/or summarising information Utility rating: Low support	1 (1.3)	39 (5.9)	24 (5.0)	24 (5.1)	6 (2.7)	6 (2.8)
Retrieval practice Utility rating: High support	7 (3.0)	43 (5.9)	15 (4.3)	11 (3.8)	8 (3.0)	16 (4.4)
Using flashcards	3 (1.8)	25 (5.3)	32 (5.7)	21 (4.8)	10 (3.5)	10 (3.7)
Spaced practice Utility rating: High support	10 (3.4)	18 (4.5)	24 (5.1)	21 (5.0)	18 (4.5)	11 (3.6)
Watching videos on the subject topic	6 (2.8)	23 (5.1)	19 (4.7)	27 (5.3)	17 (4.4)	10 (3.5)
Reading information/notes over and over Utility rating: Low support	4 (2.2)	18 (4.5)	27 (5.5)	23 (4.9)	18 (4.6)	11 (3.6)
Using mind maps	1 (1.3)	18 (4.5)	27 (5.3)	24 (5.2)	24 (5.1)	6 (2.8)
Highlighting or underlining information/text Utility rating: Low support		12 (4.0)	18 (4.5)	39 (5.8)	26 (5.2)	6 (2.8)
Listening to audio on the subject topic	10 (3.5)	11 (3.7)	16 (4.5)	18 (4.6)	24 (5.2)	22 (5.0)

Learning strategy ^a	I am not sure	Extremely helpful	Very helpful	Moderately helpful	Slightly helpful	Not at all helpful
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Elaborate encoding	24 (5.1)	10 (3.4)	14 (4.3)	9 (3.4)	22 (4.9)	21 (4.8)
Interleaved practice Utility rating: Moderate support	11 (3.6)	8 (3.0)	16 (4.2)	31 (5.6)	16 (4.4)	19 (4.7)

Note. Learning strategies are arranged from most to least helpful. ^a The six learning strategies categorised by Dunlosky et al. (2013 as high, moderate and low support we evaluated in the current study are presented alongside the utility rating for their effectiveness in enhancing learning. OR IS simpler The utility rating for the six learning strategies categorised by Dunlosky et al. (2013 as high, moderate and low support are presented alongside the strategies. Five additional learning strategies identified in the literature and in our previous work were also included (*using flashcards, using mind maps and elaborate encoding, listening to audio on the subject topic, watching videos on the subject topic*), although we do not include a utility rating for these two strategies because these were not evaluated by Dunlosky et al. (2013).

Next, we asked learners to think about the efficacy of common study resources and rank the effectiveness of the resources for learning schoolwork, study and/or revision (Table 4). We asked learners to rate how effective they thought each study resource was for independent work. Learner ratings of the effectiveness were made on a 5-point scale, from not at all helpful (1) to extremely helpful (5), and the option 'I am not sure' was also included in this question. Table 4 shows the twelve study resources and the weighted percentage scores for learners' ratings of the perceived efficacy of the resources for independent work, arranged from most to least helpful.

The study resource that scored most highly as being effective was information/notes in their class book/folder. Two additional study resources were also scored highly as being effective, including text book/guide and information uploaded by teacher(s) on school learning platforms. Online study resources such as Seneca learning and Oak National Academy were scored as being less effective by learners. Seneca learning is an online learning resource developed by researchers and is based on using effective learning strategies. However, our survey results also showed that learners were unsure about the effectiveness of these resources.

Table 4. *Weighted percentage scores for learner responses to the survey question, "How effective do you think the following learning resources are for schoolwork, study and/or revision?"*

Learning resource	I am not sure	Extremely helpful	Very helpful	Moderately helpful	Slightly helpful	Not at all helpful
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Information/notes in my class book and/or folder	5 (2.5)	35 (5.8)	30 (5.5)	20 (4.9)	3 (1.8)	8 (3.3)
Text book/guide	4 (2.2)	35 (5.8)	26 (5.3)	17 (4.5)	8 (3.4)	10 (3.7)
Information uploaded by teacher(s) on school learning platform	9 (3.3)	20 (5.1)	27 (5.5)	25 (5.1)	9 (3.3)	10 (3.5)
BBC Bitesize	1 (1.3)	29 (5.3)	29 (5.4)	23 (5.3)	4 (2.2)	15 (4.3)
WJEC website	15 (4.2)	19 (4.9)	24 (5.3)	11 (3.9)	12 (3.7)	19 (4.7)
Hwb Platform	16 (4.4)	16 (4.4)	20 (4.8)	23 (5.3)	7 (2.9)	18 (4.8)
Quizlet	10 (3.5)	13 (3.9)	10 (3.5)	27 (5.5)	16 (4.3)	24 (5.4)
Seneca Learning	33 (5.8)	10 (3.6)	4 (2.3)	6 (2.9)	9 (3.4)	38 (6.0)
Tanio.Cymru	40 (6.0)	6 (2.9)	1 (1.3)	5 (2.6)	7 (2.9)	41 (6.1)
AQA website	41 (6.0)	3 (2.3)	7 (3.2)		7 (3.1)	42 (6.0)
Khan Academy	42 (6.0)	1 (1.3)		6 (3.2)	8 (3.4)	42 (6.0)
Oak National Academy	44 (6.0)	1 (1.3)		2 (1.9)	7 (2.9)	46 (6.1)

Note. Learning resources are arranged from most to least helpful.

4.4 What influence did the pandemic have on learners' knowledge of the benefits of some commonly used and more versatile learning strategies?

We asked learners about their/ what they understand about the effectiveness of some common learning strategies, including retrieval practice, spaced practice, using flashcards and mind maps. We asked learners to select the primary reason for why they might use each of these strategies from a choice of responses presented to them. This information provides an insight into learners' awareness of the advantage of using retrieval and spaced practice as effective learning strategies. Moreover, strategies such as retrieval practice, using mind maps and using flashcards are more versatile strategies in terms of *how* they can be used because they can be used in more than one way. For example, learners might use flashcards as a retrieval practice activity (an effective learning strategy) or as a repeated reading approach (a less effective learning strategy). It was therefore important for us to understand how learners were using these more versatile strategies and whether learners were maximising on their potential. Moreover, we asked learners about their knowledge of spaced practice twice, in a different way.

Table 5 shows learners knowledge of the benefits of retrieval practice, spaced practice, using flashcards and mind maps as learning strategies and Table 6 shows learners knowledge of the benefits of spaced practice measured using a different question style.

Retrieval practice

Around half (49%) of the learners reported that retrieval practice would help them to assess their learning by identifying what they know and do not know (Table 5). A minority (30%) of the learners reported that they would use retrieval practice as an effective learning strategy. This finding suggests that most learners were not aware of the advantage of using retrieval practice as a learning strategy when studying/revising.

Spaced practice

Half (53%) of the learners reported that spacing practice would have helped them to learn and remember information when studying/revising, suggesting that learners understand that spacing is beneficial for learning (Table 5). We measured knowledge of the spacing advantage in a different way, and findings similarly showed half (51%) of the learners endorsed the long-term benefits of distributing study sessions. Few (16%) believed that studying in only one session was superior, and a minority (32%) believed that both strategies were equally effective in promoting long-term retention. This finding suggests that most learners were aware that spacing is beneficial for learning (Table 6).

Flashcards

Our survey results in Table 5 showed that most of the learners (36%) reported that using flashcards would help them to practise bringing the answer to their mind, suggesting that learners were using flashcards in an effective way as a retrieval practice activity / where learners practise recall of the answer. A minority (28%) of the learners reported that using flashcards would allow them to read information over and over, this is a less effective learning approach. This suggests that some learners might not understand that flashcards are a versatile study tool and can be used as a retrieval practice activity where learners read a question and then practise recall of the answer.

Mind maps

We asked learners to select a primary reason for why they might use mind maps to study/revise information learnt in school. Table 5 showed that a minority (31%) of the

learners reported that using mind maps would help them to identify the main topic and link this to related topics, with words that make sense to them. A similar proportion of learners (30%) reported that using mind maps would allow them to read information over and over, which is a less effective strategy.

Table 5. *Weighted percentage scores for learners’ knowledge of the benefit for using retrieval practice, spaced practice, flashcards and mind maps.*

Learning strategy	Response option	% [CI]
Retrieval practice	Using retrieval practice when I study/revise will help me to know how well I have learned the information.	49 [37.2, 61.6]
	Using retrieval practice when I study/revise will help me to learn and remember the information	30 [19.7, 42.2]
	I do not think using retrieval practice when I study/revise will help me learn and remember the information.	21 [12.6, 32.8]
Spaced practice	Spacing out my study/revision sessions over multiple days/weeks will help me to learn more information.	23 [14.1, 34.4]
	Spacing out my study/revision sessions over multiple days/weeks will help me to learn and remember the information.	53 [40.9, 65.4]
	I do not think spacing out my study/revision sessions over multiple days/weeks will help me learn and remember the information.	24 [15.0, 36.2]
Flashcards	Using flashcards when I study/revise will help me to learn because it allows me to read the information over and over.	28 [18.3, 39.8]
	Using flashcards when I study/revise will help me to learn because it allows me to practise bringing the answer to my mind.	36 [24.9, 48.4]
	Using flashcards when I study/revise will me to learn because it helps to break up the information into smaller amounts to practise.	23 [13.8, 35.4]

Learning strategy	Response option	% [CI]
	I do not think using flashcards when I study/revise will help me learn the information.	14 [7.0, 24.5]
Mind maps	Using mind maps when I study/revise will help me to learn because it allows me to read the information over and over.	30 [19.9, 42.0]
	Using mind maps when I study/revise will help me to learn because it allows me to practise bringing the information to my mind.	24 [14.7, 35.7]
	Using mind maps when I study/revise will help me to identify the main topic and link this to related topics, with words that make sense to me.	31 [20.7, 43.7]
	I do not think using mind maps when I study/revise will help me learn the information.	16 [8.4, 27.0]

Table 6. Weighted percentage scores for learners' knowledge of the benefit for using spaced practice (i.e., the spacing effect)

	Learning strategy (response option)	% [CI]
Spaced practice	Studying the material in multiple sessions of shorter duration	51 [39.1, 63.4]
	Studying the material in one longer session	16 [9.0, 27.5]
	Both of the strategies mentioned above are equally effective	32 [22.0, 44.9]

Note. We evaluated learners' awareness of spaced practice using two different questions in the present study.

4.5 How much time did learners invest towards school work and independent study?

We asked learners about how much time they spent on independent work, including schoolwork and independent study during the COVID-19 school closures. Schoolwork included any work learners were given to complete by their school teachers, and independent study is any work that learners set themselves to do and importantly does not include any work assigned by school teachers. Table 7 shows the weighted percentage of learners reporting the various number of hours of schoolwork and the number of hours of

independent study. Table 7 shows that around half (41%) of the learners spent more than seven hours a week on schoolwork. The number of hours learners reported spending on independent study during the school closures varied between none (11%) and more than 7 hours (12%).

Table 7. *Weighted percentage scores for learner responses to the survey questions, “During the COVID-19 pandemic when you were learning at home all the time and did not go to school, how many hours of schoolwork did you do at home?” and, “During the COVID-19 pandemic when you were learning at home, how many hours of independent study did you do at home when your school was closed?”*

	Number of hours a week spent on schoolwork	Number of hours a week spent on independent study
	% (SE)	% (SE)
None	3 (1.7)	11 (3.8)
Less than 1	5 (2.4)	17 (4.3)
1 to 2	9 (3.4)	14 (4.1)
2 to 3	7 (3.0)	13 (4.1)
3 to 4	8 (3.5)	14 (4.1)
4 to 5	9 (3.2)	9 (3.2)
5 to 6	11 (3.8)	7 (3.0)
6 to 7	8 (3.2)	4 (2.5)
More than 7	41 (5.8)	12 (4.0)

4.6 What influence did the COVID-19 pandemic have on learners’ confidence in using digital learning platforms?

We asked learners how they felt about using digital learning platforms, from a list of digital learning platforms that were provided by schools in Wales in response to the COVID-19 pandemic. We asked learners to rate how confident they felt about the various digital

learning platforms at the start of the COVID-19 school closures and at the present time of completing the ERaSSQ the survey (April-May 2022). Learner ratings of their confidence in using digital learning platforms were made on a 5-point scale, from not confident at all (1) to extremely confident (5), and the option 'our school / we did not use this' was also included in this question.

Table 8 shows the six digital learning platforms and the weighted percentage scores for learners' ratings of their confidence in using the digital learning platforms at the start of the COVID-19 school closures and at the present time of completing the ERaSSQ survey. Our survey results showed that at the start of the COVID-19 school closures when learners started completing schoolwork from home, learners were less confident with using all the listed digital learning platforms such as *Hwb Platform*, *Microsoft Teams*, *Google Classroom*, *Moodle* and *Show My Homework* compared with the present time of completing the survey. Learners' confidence with using the six digital learning platforms increased at different rates for the various platforms (Table 8). The digital learning platform learners scored most highly as feeling confident in using at the present time of completing the survey compared with the start of the COVID-19 schools closures was *Microsoft Teams*. There was also an increase in confidence with using Welsh Government's digital learning platform *Hwb*. However, the learners' ratings of low confidence with using *Hwb Platform* did not decrease very much (same with others?). The digital learning platforms that scored highly as not being used were *Google Classroom* and *Show my homework*.

Table 8. Weighted percentage scores for learner responses to the survey questions, "At the start of the COVID-19 school closures when you started home learning, how confident did you feel about using the following digital learning platforms" and, "How confident do you now feel about using the following digital learning platforms?"

Learning platform	Not confident at all	Slightly confident	Somewhat confident	Very confident	Extremely confident	Our school / We did not use this
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Hwb Platform Before	14 (4.1)	15 (4.4)	21 (5.0)	29 (5.3)	16 (4.2)	6 (2.7)
Hwb Platform Now	11 (3.6)	15 (4.4)	7 (3.0)	23 (5.1)	36 (5.7)	9 (3.2)
Microsoft Teams Before	6 (3.1)	23 (5.1)	24 (5.0)	21 (4.8)	23 (4.9)	4 (2.2)

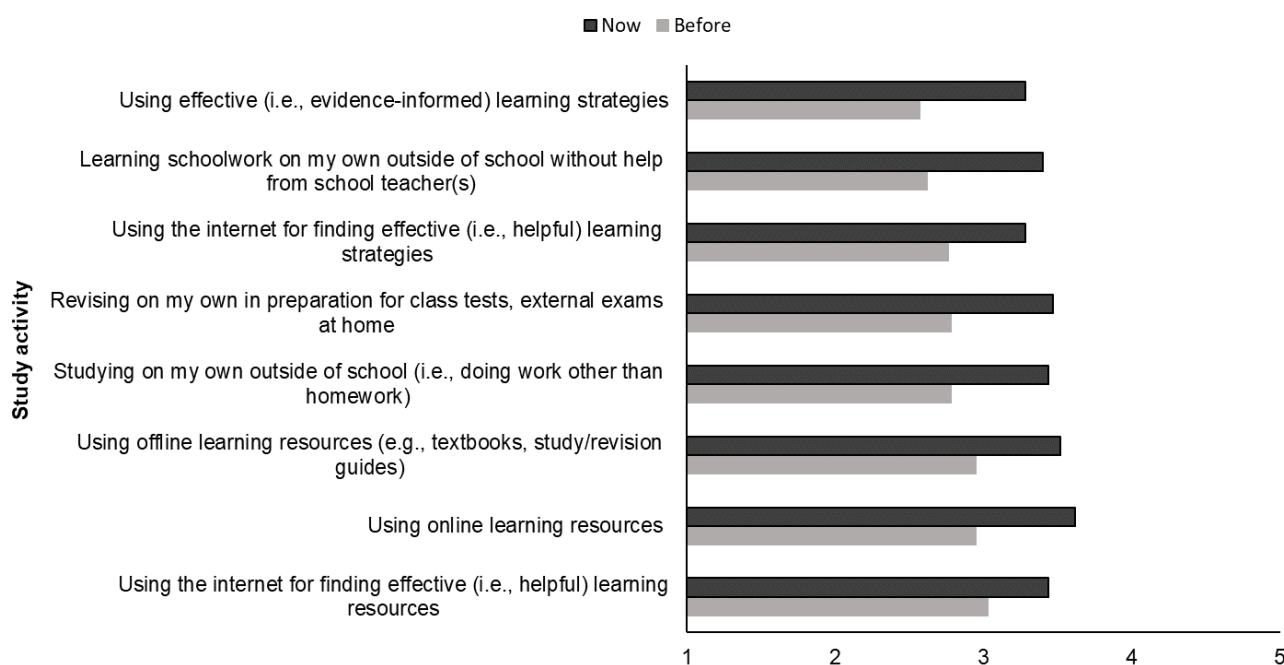
Learning platform	Not confident at all	Slightly confident	Somewhat confident	Very confident	Extremely confident	Our school / We did not use this
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Microsoft Teams Now	3 (2.2)	8 (3.2)	11 (3.6)	22 (4.9)	56 (5.9)	1 (1.2)
Google Classroom Before	16 (4.4)	11 (3.6)	6 (2.7)	15 (4.4)	16 (4.2)	36 (5.8)
Google Classroom Now	15 (4.3)	9 (3.5)	9 (3.5)	13 (4.2)	16 (4.3)	37 (5.8)
Moodle Before	23 (4.9)	18 (4.7)	18 (4.5)	17 (4.5)	9 (3.4)	16 (4.4)
Moodle Now	22 (4.9)	11 (3.6)	11 (3.8)	14 (4.2)	27 (5.2)	16 (4.3)
Show my homework Before	20 (4.9)	9 (3.4)	11 (3.6)	13 (4.0)	16 (4.4)	31 (5.5)
Show my homework Now	17 (4.6)	5 (2.4)	9 (3.2)	17 (4.5)	22 (4.9)	30 (5.5)

4.7 What influence did the COVID-19 pandemic have on learners' confidence towards independent learning?

We asked learners how they felt about undertaking independent study from a list of different study activities. We asked learners to rate how confident they felt about each independent learning activity at the start of the COVID-19 school closures and at the time of completing the survey (April-May 2022). Learner ratings of the study activities were made on a 5-point scale, from not confident at all (1) to extremely confident (5). Figure 10 shows how confident learners felt about undertaking each independent learning activity at the start of the COVID-19 school closures and at the present time of completing the survey (higher weighted mean scores indicate learners rated higher confidence in undertaking the activity). The weighted percentages of learners reporting the various frequencies for their confidence (in

undertaking) per study activity are presented in Table C.1 (see Appendix C). A clear improvement on learners' confidence in undertaking the listed study activities emerged with respondents giving a higher rating to all the study activities at the present time of completing the survey compared to at the start of the COVID-19 school closures (Figure 10). Our results showed learners rated feeling *slightly confident* in undertaking most of the listed study activities at the start of the COVID-19 school closures (Figure 10). The study activity learners scored most highly as feeling confident in undertaking at the start of the school closures was *using the internet for finding effective (i.e., helpful) learning resources* and learners rated feeling *somewhat confident* in undertaking this activity. Learners' confidence in undertaking the independent study activities increased with learners giving a higher confidence rating to all the study activities at the present time of completing the survey (Figure 10). Our results showed learners rated feeling either *somewhat* or *very confident* in undertaking each independent activity.

Figure 10 Weighted mean scores for learner responses to the survey questions, “At the start of the COVID-19 school closures, how confident did you feel about each of the following aspects of learning” and, “How confident do you now feel about each of the following aspects of learning”?



Note. Learners' ratings of how confident they felt about each independent study activity at the start of the COVID-19 school closures and at the time of completing the survey was made on a 5-point scale, from not confident at all (1) to extremely confident (5). Higher scores indicate that the learners rated feeling more confident in undertaking the study activities.

4.8 Where does learners' knowledge of learning strategies and study resources come from?

We asked learners where their knowledge of learning strategies and study resources came from. We asked learners to identify the source(s) of their knowledge on learning strategies

and study resources from a list of relevant sources. Table 9 shows the percentage of learners reporting the various sources of their knowledge of strategies and the various sources of their knowledge of resources. Our survey results in Table 9 indicate that many learners identified their 'school teacher' as the source of knowledge on learning strategies and study resources. Half reported that their knowledge of learning strategies and study resources were derived 'online' (Table 9). Similarly, half identified their 'friend(s)/peers' as the source of their knowledge on learning strategies and study resources (Table 9). A minority reported that their knowledge of learning strategies and study resources were derived from 'parents/carers'.

Table 9. *Percentage scores for learners' reporting where does their knowledge of learning strategies and study resources come from*

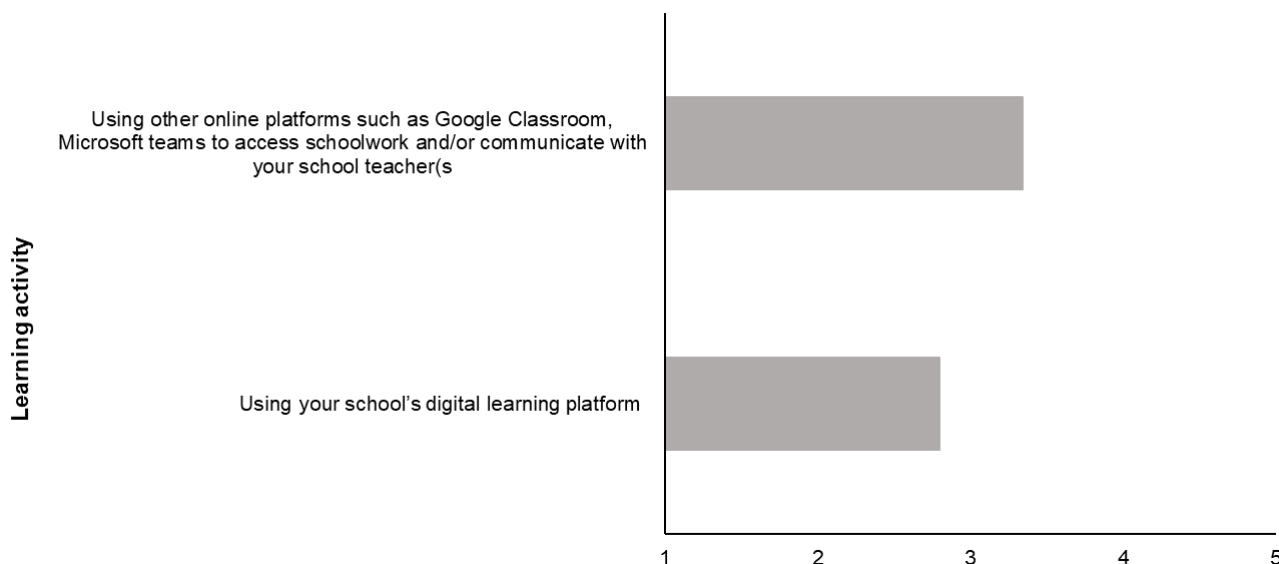
Source	Learning strategy	Learning resource
	%	%
School teacher(s)	83	82
Online (e.g., learning resources, social media)	58	59
Friend(s)/peers	53	56
Parents/carers	40	35
School study/revision tutor	15	15
Private tutor(s)	8	8
School study/revision support centre	7	3

4.9 How helpful was the support from schools with home learning?

We asked learners about the support provided from schools to help learners with independent work. We asked learners to rate how helpful was the support provided from schools with home learning. Learner ratings of the support from schools for home learning activities were made on a 5-point scale, from not at all helpful (1) to extremely helpful (5). Figure 11 shows learners ratings of the helpfulness of the support provided from schools with home learning (higher weighted mean scores indicated that the learners rated the support from schools as more helpful). The weighted percentages of learners reporting the various frequencies for the support from school per home learning activity are presented in Table C.2 (see Appendix C). Learners rated the support received from schools with home

learning activities such as using internal and external digital learning platforms as being moderately helpful (Figure 11).

Figure 11 *Weighted mean scores for learner responses to the survey question, “During the COVID-19 school closures, how helpful was the support you received from your school for the following aspects of home learning”?*



Note. Learners’ ratings of how helpful the support provided from schools with home learning was made on a 5-point scale, from not at all helpful (1) to extremely helpful (5). Higher scores indicate that the learners rated the support provided from schools for the learning activities as more helpful.

4.10 Is there a demand for information about evidence-informed learning strategies and/or study resources?

We asked learners whether there is a need to provide additional information and support on the use of evidence-informed learning strategies and study resources. We asked learners whether they should be provided with information on effective learning strategies and study resources and also whether learners would be interested in receiving such information. Our survey results showed many learners (71%) were interested in receiving information about effective learning strategies and study resources to help them with independent learning (Table 10). In addition, many learners (82%) would welcome information about effective learning strategies and study resources to support their independent learning in the event of future emergencies (Table 10).

Table 10. *Weighted percentage scores for learner responses to the survey questions about availability and demand for support with study/revision*

Survey item	Response option	%	SE
Do you think that you should be provided with information about effective learning strategies and/or learning resources to help with schoolwork, study/revision in the event of any future school closures?	Yes	82	4.9
	No	17	4.9
Would you be interested in receiving information about effective (i.e., evidence-informed) learning strategies and/or learning resources that will help you to learn schoolwork, study/revise effectively?	Yes	71	5.6
	No	28	5.6

5. Discussion

In this report we used a multistage clustered sample design to evaluate the impact of the COVID-19 pandemic on the independent study practice of learners aged 14–15 and 16–17 years in Wales. We explored learners' use and understanding of common learning strategies and study resources for independent work, study and/or revision since the start of the school closures caused by the COVID-19 pandemic until the present day. In addition, we report on the time learners invested towards schoolwork and independent study, and how confident they were in using digital learning platforms and independent study activities at the start of the COVID-19 pandemic and at present. Importantly, we also report on learners' source of knowledge on learning strategies and study resources, as well as the support learners received from schools for independent work. In the following section we discuss our findings on each of these aspects.

5.1 Use of study resources and learning strategies

Our results showed that the study resources provided by schools were most frequently used by learners for independent work whilst at home, including *information/notes in their class book/folder* and *information notes uploaded by teacher(s) on the school's digital learning platform*. BBC Bitesize was a frequently used online study resource by learners and the Oak National Academy (a resource developed by teachers in England in response to the COVID-19 pandemic) was the least frequently used online study resource. These findings align with the outcomes of the WISERD (2020) survey. In the present study we also assessed learners' understanding of the effectiveness of study resources and found that the newly developed Oak National Academy resource was ranked among the least effective study resources by learners. It is important to note that our survey results also showed that 33 per cent of learners reported that they were unsure about the effectiveness of this resource and this might explain why more learners chose not to use the Oak National Academy resource.

In the present survey, learners reported more frequently using the Welsh Government's Hwb platform. In contrast, the WISERD survey (2020) showed that 64 per cent of learners reported that they had not used this national study resource. A possible explanation for this might be due to the differences in the timeline between the survey completion dates in the present study and in the WISERD survey (2020). The current study survey with school learners was completed between April and May 2022, whereas the WISERD survey with school learners was completed before the end of the 2019-20 summer term. It may be that learners were less familiar and/or less confident with using the Hwb platform when they first started using digital learning platforms for remote learning. For example, our survey also found that at the start of the COVID-19 school closures when learners started completing schoolwork from home, learners were less confident with using digital learning platforms such as *Hwb*, *Microsoft Teams*, *Google Classroom*, *Moodle* and *Show My Homework* compared with the present time of completing the survey. There was an increase in confidence with using Welsh Government's digital learning platform *Hwb* at the time of completing the survey in the current study (April-May 2022).

We also explored which learning strategies learners were using to help them with independent work whilst accessing the various study resources. Our findings showed that most learners were using both higher and lower utility strategies to complete tasks whilst accessing the most commonly used study resources. The lower utility learning strategies were highlighting and/or underlining information/text, reading information/notes over and

over and making notes and/or summarising information for accessing information/notes uploaded by teacher(s) on their school's digital learning platforms, information/notes in their class book/folder and/or whilst using the BBC Bitesize website. We also found that learners reported using medium to higher utility strategies such as elaborate encoding, interleaved practice, and spaced practice (a higher utility strategy), less frequently. These findings align with the outcomes of previous studies which found that secondary learners mostly relied on less optimal learning strategies such as making notes, repeatedly reading information, highlighting and/or underlining information for independent work compared to more effective learning strategies including retrieval and spaced practice (Agarwal et al., 2014; Dirx et al., 2019; Sultana et al., 2023). These findings suggest that learners' choice of strategies has not changed over recent years and, importantly, despite the need for learners to work more independently during the COVID-19 school closures, their use of learning strategies has not changed since the start of the pandemic. Our findings highlight the need for schools to continue to improve awareness about effective learning strategies and study resources.

5.2 Understanding of learning strategies and study resources

The present study has shown that learners have limited to moderate understanding of the effectiveness of commonly used learning strategies. The learning strategy that scored most highly by learners as being effective was making notes and/or summarising information (a strategy rated as lower utility by Dunlosky et al. [2013]). Learners' opinions of the effectiveness of some commonly used learning strategies indicate that they do not realise that these strategies may not be among the most effective. This suggests that learners have some mistaken beliefs about the efficacy of commonly used learning strategies, and this might explain why learners continue to use these approaches. Importantly, these findings also suggest that despite the need for learners to work more independently during the COVID-19 school closures, learners' understanding of the utility of learning strategies have not changed since the start of the COVID-19 pandemic.

Retrieval practice, categorised by Dunlosky et al. (2013) as a higher utility approach, was also rated highly by learners. However, when interpreting these findings it is important to consider that our survey also found that about half of learners reported that they would use retrieval practice as a strategy to help them assess their learning, or to help them identify what they know and or do not know rather than as an effective learning strategy. This finding suggests that most learners were not aware of the advantage of using retrieval practice as a learning strategy for independent work. This finding aligns with the outcomes of earlier studies which found that secondary learners predominantly used retrieval activities for diagnostic purposes (Agarwal et al., 2014; Sultana et al., 2023). It is possible learners might not be using retrieval practice as a learning strategy due to their experience of completing retrieval practice activities for summative purposes in school.

Half of the learners reported that spacing practice would have helped them to learn and remember information when studying and/or revising, suggesting that learners understand that spacing is beneficial for learning. Further evidence indicating awareness of the spacing advantage came from our survey question that asked learners to select a strategy that research has shown to be an effective learning approach. Similarly, we found half of the learners endorsed the option on the long-term benefits of spacing study sessions. However, in this study, fewer learners reported using spaced practice to help them learn whilst accessing various study resources. Findings from an earlier study with secondary learners in North Wales indicated that learners were aware of the spacing advantage, although these learners similarly reported using this strategy less frequently (Sultana et al., 2023). The inconsistency between learners' knowledge and utilisation of spaced practice may be partly

because it is a strategy that advises on *when* to practice instead of *how* to practice. Despite the need for learners to work more independently during the COVID-19 school closures, learners' understanding of the utility of learning strategies have not changed since the start of the COVID-19 pandemic.

The study resources learners ranked as effective for independent work were information/notes in their class book/folder, text book/guide and information uploaded by teacher(s) on the school's learning platform. Online study resources such as Seneca learning and Oak National Academy were scored as being less effective by learners. Seneca learning is an online learning resource developed by researchers and is underpinned by retrieval practice methodology. Learners' ratings of the effectiveness of some learning resources suggests that they might not be fully aware of their utility. This could be in part due to their lack of experience with using online study resources prior to the school closures. These findings indicate learners would benefit from receiving more information about the utility of some study resources. Previous studies in this field with learners have been limited to exploring their use of study resources (WISERD, 2020; Mylona & Heledd, 2021). This is the first study to assess learners' understanding of the effectiveness of study resources. This study has provided an insight into learners' understanding of the utility of commonly used study resources and, importantly, the results highlight the need for educators to ensure an appropriate repository of resources are created and made available for schools and colleges.

5.3 Confidence levels towards digital learning platforms

Other factors that may have affected the ability of learners to undertake independent work include their confidence in using digital learning platforms; confidence in undertaking independent study activities; and, their ability to source knowledge on learning strategies and study resources. Findings from a study with 16–19 year old learners' experiences at the start of the pandemic indicated that although some learners were provided with digital devices, there was a lack of guidance from schools on how to use the hardware, and this was a barrier to learning (Mylona & Heledd, 2021). Our data on learners' confidence when using digital learning platforms at the start of the COVID-19 school closures shows that they were less confident when using digital learning platforms such as the *Hwb platform*, *Microsoft Teams*, *Google Classroom*, *Moodle* and *Show My Homework*. Our findings also show learners' confidence levels towards the same digital learning platforms improved over time, with learners now reporting higher levels of confidence in using key digital platforms such as *Hwb* and *Microsoft Teams*. Importantly, learners now report feeling more confident in using key digital learning platforms compared to the start of the COVID-19 pandemic. When interpreting these promising results, it is important to note that our survey results also showed that the percentage of learners reporting low confidence in using the *Hwb* platform did not decrease a lot. Our results show that learners would benefit from receiving more information and support/guidance about how to use key digital learning platforms such as *Hwb*.

5.4 Confidence levels towards independent study activities

At the start of the COVID-19 pandemic, learners rated feeling *slightly confident* in undertaking most of the study activities, including *using effective (evidence-informed) learning strategies*, *learning schoolwork on my own outside of school without help from*

school teacher(s), studying on my own outside of school (i.e., doing work other than homework), revising on my own in preparation for class tests/external exams at home, using the internet for finding effective (i.e., evidence informed) learning strategies), using offline learning resources (e.g., textbooks, study/revision guides), and using online learning resources. One reason learners might have experienced challenges with learning schoolwork on their own could be due to their lack of information and guidance to help them use more effective independent study and revision skills. Similarly, a study by Morgan (2020) showed that most university learners reported that they had not utilised independent study at home prior to coming to university. After the COVID-19 pandemic, confidence levels increased for all learning activities and this is likely to have been driven by the need for learners to work independently during schools' remote learning provision during lockdown. Nonetheless, these findings highlight the need for schools to continue to improve learners' awareness about independent study and revision skills.

5.5 Efforts towards schoolwork and independent study

Our findings show that around half of the learners spent more than seven hours a week on schoolwork. In the WISERD (2020) survey most learners reported spending six to ten hours a week completing schoolwork. In the present study, we also assessed the duration of independent study learners undertook. In contrast to schoolwork, which included any work learners were given to complete by their school teachers, independent study included any work that learners set themselves and did not include any work assigned by school teachers. Results show that the number of hours learners reported spending on independent study during the school closures varied between zero to more than seven hours per week. Results from an earlier study with school learners in North Wales showed that 40 percent reported studying on their own for less than one hour in a typical week (Sultana et al., 2023). In addition to educating learners about more effective study resources and learning strategies, teachers also need to ensure they also teach learners about the importance of investing time for independent study and revision. Oakes and Griffin (2016) proposed one way to encourage high levels of effort is to communicate how many hours a week learners should consider investing for independent study.

5.6 Source of knowledge on learning strategies and learning resources

Many of the learners in this study reported that their knowledge of learning strategies (83%) and learning resources (82%) had derived from their school teacher(s). In this study we did not evaluate what learning strategies and/or resources school teachers might have used to promote independent learning during the school closures. Previous studies with university instructors show that university instructors promote both less- and more-effective learning strategies and have a moderate understanding about evidence-informed learning strategies (McCabe, 2018; Piza, 2018; Morehead et al., 2016). Results from an earlier study with secondary learners in North Wales showed that most learners (93%) reported that their science teacher(s) encouraged them to use retrieval practice, an effective learning strategy (Sultana et al., 2023). However, when interpreting these promising results, it is important to consider that we have previously found that most learners reported they would complete retrieval practice as a diagnostic tool to assess their knowledge rather than as a learning strategy. A survey with science subject leaders on their understanding and recommendation

of learning strategies also showed that they would recommend retrieval activities to help learners assess their learning rather than as learning strategy (Sultana, 2023).

Parents/carers are an important source of information and guidance for learners for independent learning. In the current study, we found that a minority of learners reported that their knowledge of learning strategies (40%) and study resources (35%) were derived from 'parents/carers'. Studies on the impact of the COVID-19 pandemic show that learners benefitting from more parental guidance and support made more progress despite the COVID-19 school restrictions (Waters-Davies et al., 2021; Department for Education, 2022). These studies show that there is an important role for parents/carers to promote independent learning and effective learning strategies. Further research now needs to focus on how best to communicate this information to parents/carers.

5.7 Support from schools

The findings here show that learners rated the support received from schools for using their school's digital learning platform and using other online platforms as *moderately helpful*. Learners would welcome more information and support with independent work. Our findings also show many (71%) learners reported that they were interested in receiving information about effective learning strategies and resources to help them with independent learning. Many (82%) of the learners also reported that they should be provided with information about effective learning strategies and resources to support their independent learning in the event of future emergencies.

5.8 Strengths and limitations

We acknowledge some limitations in the current study. There was some non-response to the survey because not all sampled units, including schools and learners were observed. To attempt to more appropriately represent learners we made weighting adjustments to compensate for non-response. To correct for the non-response, we weighted learners' data to use post-stratification techniques. For post-stratification our aim was to match the responding dataset to the school population data set for the number of learners in Year 10 and Year 12. However, the number of variables to build a non-response model was limited to only one, which was the total year group numbers. This was the information that we had access to for both respondents and non-respondents. It would have been helpful to have access to a wider range of information to enable us to check whether other potential variables were related to the non-response process, and there remains a possibility of some uncorrected left-over nonresponse bias in our data. We also anticipated a higher response rate for the survey and despite several reminders to schools the present study received a lower response rate than expected. There has been a decrease in response rates in general population surveys, and this might be a reason for the lower response rate observed in the current study (Luiten, Hox, Leeuw, 2020).

5.9 Recommendations

Recommendations for Welsh Government

1. Welsh Government should communicate the importance of independent learning skills, and provide guidance to improve teachers' knowledge of higher utility independent learning skills that learners can use in secondary and further education settings.

2. Welsh Government should ensure that an appropriate repository of study skill resources is made available for schools and colleges to help learners use more effective study and revision strategies across a range of subject areas.
3. Welsh Government should also work with the regional consortia and Estyn to ensure that schools receive appropriate guidance and best practice case studies to help embed the use of effective learning strategies in education settings.

Recommendations for middle tier organisations (i.e., Local Authorities, ESTYN, School Improvement Agencies, Qualifications Wales)

4. Middle tier organisations should work with Welsh Government and schools to communicate the importance of independent learning skills by providing guidance to improve teachers' knowledge of higher utility independent learning skills to help learners in secondary and further education settings.
5. Middle tier organisations should monitor the implementation of independent learning intervention programmes in school and college settings. They should ensure initial teacher education programmes, and support for newly qualified teachers, includes provision for understanding the importance of supporting learners to use effective independent learning skills.

Recommendations for school leaders and practitioners

6. Schools should work with teaching staff to more clearly exemplify effective independent study and revision strategies. Schools should also provide learners with information about how to use some of the more effective learning strategies such as retrieval and spaced practice and communicate the importance of how these strategies can be used as part of purposeful independent learning and revision.

Recommendations for future research

7. Our study did not evaluate parents' and carers' understanding of independent learning skills. Future research should be conducted with parents and carers to explore how they can promote the use of effective learning strategies at home.

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Appendices

Appendix A: ERaSSQ survey

Please refer to the supporting word documentation for a copy of the ERaSSQ survey.

Appendix B: Changes made to the ERaSSQ survey for the present CEN study

Table B 1. *Overview of modifications to the ERaSSQ survey*

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
N/A	<p>Since the start of the COVID-19 pandemic until the present day, how often did you use the following learning resources to learn schoolwork, study and/or revise at home? Please tick the box.</p> <p>Response options: <i>Never, rarely, sometimes, most of the time, always</i></p>	<p>This was a new survey item added to measure learners use of study resources. The survey item reflects the change in the delivery of schoolwork as learners were required to undertake independent work during the pandemic.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
<p>How often do you use the following learning strategies when you study/revise for science? Please tick the box that best describes your answer.</p> <p>List of learning strategies: <i>Using mind maps</i> <i>Highlighting or underlining information/text</i> <i>Using flashcards</i> <i>Reading information/notes over and over</i> <i>Making notes (summarising)</i> <i>Spaced practice (spreading study/revision sessions over time)</i> <i>Doing practice tests (e.g., past papers)</i> <i>Interleaved practice (mixing different science subjects or science topics while studying/revising)</i> <i>Elaborate encoding (connecting what you are trying to learn to what you already know e.g., remembering the colours on the visible spectrum by learning the following sentence; Richard Of York Gave Battle in Vain [Red Orange, Yellow, Green, Blue, Indigo, Violet])</i></p> <p>Likert scale options: <i>Never, rarely, sometimes, most of the time, always</i></p>	<p>Since the start of the COVID-19 pandemic until the present day, for any of the learning resources listed below have you used and/or made your own mind maps whilst accessing any of these learning resources for schoolwork, study and/revision at home? Please tick all boxes that apply.</p> <p>The same survey item was repeated nine times and used for each of the nine learning strategies assessed in the present study;</p> <p><i>Using mind maps</i> Modified: <i>Highlighting and/or underlining information/text</i> <i>Using flashcards</i> <i>Reading information/notes over and over</i> Modified: <i>Making notes and/or summarising information</i> Modified: <i>Spaced practice (Spaced practice involves spreading your study time and going over the same information)</i> Modified: <i>Retrieval practice (Retrieval practice includes answering past paper questions, quizzes, being tested by someone else or any other activity which involves remembering information from memory without looking at the information that you are trying to remember)</i> Modified: <i>Interleaved practice (i.e., organising your study time so that you mix different kinds of problems or topics within a single study session)</i> <i>Elaborate encoding (involves connecting what you are trying to learn to what you already know e.g. remembering the colours on the visible spectrum by learning the following sentence; Richard Of York Gave Battle in Vain [Red, Orange, Yellow, Green, Blue, Indigo and Violet]). These are called mnemonics.</i></p>	<p>This survey item was modified for the present study. The initial version was designed to measure which learning strategies learners use for independent work. For the current study, we modified this survey item to measure which learning strategies learners were using whilst accessing the various study resources for independent work.</p> <p>Minor modifications were also made to the learning strategy terms as well as the definitions of the learning strategies included in survey items. These are highlighted as being modified.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
<p>There are two parts to this question. For the first part, using the list of learning strategies above, please write down on the dotted line below, the THREE learning strategies that YOU most frequently use when you study/revise for science. For the second part, please tick the boxes to show how well YOU think the THREE strategies that YOU have written down help you learn when you study/revise for science.</p> <p>List of learning strategies: <i>Using mind maps</i> <i>Highlighting or underlining information/text</i> <i>Using flashcards</i> <i>Reading information/notes over and over</i> <i>Making notes (summarising)</i> <i>Spaced practice (spreading study/revision sessions over time)</i> <i>Doing practice tests (e.g., past papers)</i> <i>Interleaved practice (mixing different science subjects or science topics while studying/revising)</i> <i>Elaborate encoding (connecting what you are trying to learn to what you already know e.g., remembering the colours on the visible spectrum by learning the following sentence; Richard Of York Gave Battle in Vain [Red, Orange, Yellow, Green, Blue, Indigo, Violet])</i></p> <p>Likert scale options: <i>Not at all helpful, slightly helpful, moderately helpful, very helpful, extremely helpful</i></p>	<p>How effective (i.e., helpful) do you think the following learning strategies are for schoolwork, study and/or revision. Please tick the box that best describes your answer.</p> <p>List of learning strategies: <i>Using mind maps</i> Modified: <i>Highlighting and/or underlining information/text</i> <i>Using flashcards</i> <i>Reading information/notes over and over</i> Modified: <i>Making notes and/or summarising information</i> Modified: <i>Spaced practice (Spaced practice involves spreading your study time and going over the same information)</i> Modified: <i>Retrieval practice (Retrieval practice includes answering past paper questions, quizzes, being tested by someone else or any other activity which involves remembering information from memory without looking at the information that you are trying to remember)</i> New strategy: <i>Watching videos on the subject topic</i> New strategy: <i>Listening to audio on the subject topic</i> Modified: <i>Interleaved practice (i.e., organising your study time so that you mix different kinds of problems or topics within a single study session)</i> <i>Elaborate encoding (involves connecting what you are trying to learn to what you already know e.g. remembering the colours on the visible spectrum by learning the following sentence; Richard Of York Gave Battle in Vain [Red, Orange, Yellow, Green, Blue, Indigo and Violet]). These are called mnemonics.</i></p> <p>Likert scale options: <i>Not at all helpful, slightly helpful, moderately helpful, very helpful, extremely helpful, I am not sure</i></p>	<p>In the current study we asked learners to rate the effectiveness of all the listed learning strategies. Learners could also select the 'I am not sure' option. In contrast, in the initial version of the ERaSSQ survey, we asked learners to first list three strategies they most frequently use and only evaluate those strategies on their helpfulness.</p> <p>Following peer review in an academic journal this survey item was modified to measure learners' understanding of the effectiveness of all learning strategies, to create an overview of what learners understand to be the most and least effective strategies.</p> <p>Was modified due to the restricted nature of the question format and to create an overview of how students assess the effectiveness of all nine (or perhaps even more) strategies.</p> <p>Two additional strategies identified from the findings to the open-response questions in our earlier survey were included (<i>watching videos on the subject topic, listening to audio on the subject topic</i>).</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
N/A	<p>How effective (i.e., helpful) do you think the following learning resources are for schoolwork, study and/or revision. Please tick the box that best describes your answer.</p> <p>List of learning resources: BBC bitesize, Quizlet, Tanio.Cymru, Hwb Platform, WJEC website, AQA website, Khan Academy, Oak National Academy, Seneca Learning, Text book/guide, Information/notes uploaded by your teacher(s) on your school's digital learning platform or other online platforms such as Google Classroom and Microsoft Teams, Information/notes in my class book and/or folder</p> <p>Likert scale options: <i>Not at all helpful, slightly helpful, moderately helpful, very helpful, extremely helpful, I am not sure</i></p>	<p>This was a new survey item added to measure learners' understanding of the effectiveness of study resources. The survey item reflects the change in the delivery of schoolwork as learners were required to undertake independent work during the pandemic.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
N/A	<p>During the COVID-19 pandemic think about a week when you were learning at home all the time and did not go to school. For that week, how many hours of schoolwork did you do at home. Please tick ONE box. <i>Schoolwork is any work that your teacher asked you to do and given to you by your teacher(s) (i.e., classwork, online classroom lessons with your teacher(s)).</i></p> <p>Response options: <i>None, less than 1 hour a week, 1-2 hours a week, 2-3 hours a week, 3-4 hours a week, 4-5 hours a week, 5-6 hours a week, 6-7 hours a week, more than 7 hours a week</i></p>	<p>This was a new survey item added to measure the time learners spent on schoolwork during the COVID-19 school closures. The survey item reflects the change in the delivery of schoolwork as learners were required to undertake independent work during the pandemic.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
<p>In a typical week how many minutes/hours of study do you do for science outside of lessons? Please tick the box.</p> <p>Response options: <i>Less than 1 hour study a week, 1-2 hours study a week, 2-3 hours study a week, 3-4 hours study a week, 4-5 hours study a week, 5-6 hours study a week, 6-7 hours study a week, more than 7 hours study a week</i></p>	<p>During the COVID-19 pandemic think about a week when you were learning at home. How many hours of independent study did you do at home when your school was closed. Please tick ONE box. <i>Independent study can be spending some time going over the schoolwork that you have learned by yourself, or any additional work that you set yourself to do.</i></p> <p>Response options: <i>None (new option), less than 1 hour a week, 1-2 hours a week, 2-3 hours a week, 3-4 hours a week, 4-5 hours a week, 5-6 hours a week, 6-7 hours a week, more than 7 hours a week</i></p>	<p>This survey item was modified for the present study, including changes to the wording of the survey question and response options.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
N/A	<p>At the start of the COVID-19 school closures when you started home learning, how confident did you feel about using the following digital learning platforms? Please tick the box that best describes your answer.</p> <p>How confident do you NOW feel about using the following digital learning platforms. Please tick the box that best describes your answer.</p> <p>List of digital learning platforms: <i>Hwb Platform, Microsoft Teams, Google classroom, Moodle, Show my homework</i></p> <p>Response options: <i>Not confident at all, slightly confident, somewhat confident, very confident, extremely confident, our school did not use this / We did not use this</i></p>	<p>These were two new survey items added to measure learners' confidence in using digital learning platforms at the start of COVID-19 school closures and at the present time of completing the ERaSSQ the survey (April-May 2022). The survey item reflects the change in the delivery of schoolwork as learners were required to undertake independent work during the pandemic.</p>

<p>N/A</p>	<p>At the start of the COVID-19 school closures, how confident did you feel about each of the following aspects of learning? Please tick the box that best describes your answer.</p> <p>How confident do you NOW feel about each of the following aspects of learning? Please tick the box that best describes your answer.</p> <p>List of study activities: <i>Learning schoolwork on my own outside of school without help from school teacher(s)</i> <i>Using online learning resources</i> <i>Using the internet for finding effective (i.e., helpful) learning resources</i> <i>Using effective (i.e., evidence-informed) learning strategies</i> <i>Using the internet for finding effective (i.e., helpful) learning strategies</i> <i>Using offline learning resources (e.g., textbooks, study/revision guides)</i> <i>Studying on my own outside of school (i.e., doing work other than homework)</i> <i>Revising on my own in preparation for class tests, external exams at home</i></p> <p>Response options: <i>Not confident at all, slightly confident, somewhat confident, very confident, extremely confident, our school did not use this / We did not use this.</i></p>	<p>These were two new survey items added to measure learners' confidence in using digital learning platforms at the start of COVID-19 school closures and at the present time of completing the ERaSSQ the survey (April-May 2022).</p>
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Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
N/A	<p>If you know about any of these learning strategies, please tell us where you found out about them? Please tick all boxes</p> <p>We used the same abovementioned list of learning strategies.</p> <p>If you know about any of these online/offline learning resources, please tell us where you found out about them? Please tick all boxes that apply.</p> <p>We used the same above mentioned list of learning resources.</p>	<p>These were two new survey items added to measure where learners' knowledge of learning strategies and study resources came from.</p> <p>Following peer review in an academic journal this survey item was added to measure where learners' knowledge about learning strategies and resources came from. To gain a better understanding of learners independent study practice.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
<p>Imagine that you are planning to study and/or revise for an upcoming science test. Please tick the option that best describes your answer, for why you might use do practice tests (e.g., past papers) to study/revise in preparation for the test.</p> <p>Response options: <i>Doing practice tests when I study/revise will help me to know how well I have learned the information for the science tests.</i> <i>Doing practice tests when I study/revise will help me to learn and remember the information for the science test.</i> <i>I do not think doing practice tests when I study/revise will help me learn and remember the information for the science test.</i></p> <p>We used the same above question style to measure learners' understanding of the learning strategies spaced practice, using mind maps and using flashcards.</p>	<p>Imagine that you are planning to study and/or revise for some information that you have learned in school. Please tick the option that best describes why you might use retrieval practice to study/revise the information that you have learned in school. Retrieval practice includes answering past paper questions, quizzes, being tested by someone else or any other activity which involves remembering information from memory without looking at the information that you are trying to remember. Please only tick ONE option</p> <p>Response options: <i>Using retrieval practice when I study/revise will help me to know how well I have learned the information.</i> <i>Using retrieval practice when I study/revise will help me to learn and remember the information.</i> <i>I do not think using retrieval practice when I study/revise will help me learn and remember the information.</i></p> <p>We used the same above mentioned question style to measure learners' understanding of the learning strategies spaced practice, using mind maps and using flashcards.</p>	<p>This survey item was modified for the present study, including changes to the wording of the survey question, the term used for the learning strategy in the survey question and response options.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
N/A	<p>Which of the following strategies do you think research has found to be better for long-term retention of material (i.e., for remembering information), assuming the total amount of study is the same? Please only tick ONE option.</p> <p>Response options: <i>Studying the material in multiple session of shorter duration</i> <i>Studying the material in one longer session</i> <i>Both strategies are equally effective (i.e., helpful)</i></p>	<p>This was a new survey item added to measure learners' understanding of the learning strategy spaced practice in a different way.</p> <p>Findings from our earlier survey showed learners understand the benefits of spaced practice, however, reported using this effective strategy less frequently compared with other less effective strategies. It was therefore important to assess learners' understanding of spacing practice using a different question.</p>
N/A	<p>During the COVID-19 school closures, how helpful was the support you received from your school for the following aspects of home learning. Please tick the box that best describes your answer</p> <p>Aspects of home learning: <i>Using your school's digital learning platform</i> <i>Using other online platforms such as Google Classroom, Microsoft Teams to access schoolwork and/or communicate with your school teacher(s)</i></p> <p>Response options: <i>Not at all helpful, somewhat helpful, moderately helpful, very helpful, extremely helpful</i></p>	<p>New survey item related to the COVID-19 pandemic.</p>

Survey item used in earlier version of ERaSSQ	Survey item used in present version of ERaSSQ for study	Description
<p>Do you think that you should be provided with information about effective learning strategies to help study/revise for science? Please tick the box.</p> <p>Response options: Yes No</p>	<p>Do you think that you should be provided with information about effective learning strategies and/or learning resources to help you with schoolwork, study/revision in the event of any future school closures? Please tick the box.</p> <p>Response options: Yes No</p>	<p>This survey item was modified for the present study, including minor changes to the wording of the survey question that related to the COVID-19 pandemic.</p>
<p>Would you be interested in receiving information about evidence-based learning strategies that will help you to study/revise effectively for science? Please tick the box.</p> <p>Response options: Yes No</p>	<p>Would you be interested in receiving information about effective (i.e., evidence-informed) learning strategies and/or learning resources that will help you to learn schoolwork, study/revise effectively? Please tick the box.</p> <p>Response options: Yes No</p>	<p>This survey item was modified for the present study, including minor changes to the wording of the survey question that related to the COVID-19 pandemic.</p>

Note. There were additional survey items in the initial version of the ERaSSQ which we did not include nor change for the modified version of the ERaSSQ used in the present study. For this reason we have excluded those survey items in this table.

Appendix C: Frequency outcomes for survey items

Table C 1. Weighted percentage scores for learner responses to the survey questions, “At the start of the COVID-19 school closures, how confident did you feel about each of the following aspects of learning” and, “How confident do you now feel about each of the following aspects of learning”?

Study skill	Not confident at all	Slightly confident	Somewhat confident	Very confident	Extremely confident
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Learning schoolwork on my own outside of school without help from school teacher(s) Before	21 (5.1)	26 (5.2)	30 (5.6)	16 (4.3)	7 (3.1)
Learning schoolwork on my own outside of school without help from school teacher(s) Now	6 (2.9)	14 (4.0)	31 (5.7)	34 (5.8)	15 (4.4)
Using online learning resources Before	13 (4.3)	15 (4.4)	39 (5.9)	27 (5.5)	5 (2.5)
Using online learning resources Now	7 (3.1)	8 (3.3)	24 (5.1)	37 (5.9)	24 (5.1)
Using the internet for finding effective (i.e., helpful) learning resources Before	10 (3.8)	21 (5.0)	37 (5.8)	19 (4.9)	12 (3.9)
Using the internet for finding effective (i.e., helpful) learning resources Now	9 (3.6)	6 (2.8)	33 (5.7)	34 (5.8)	17 (4.6)

Study skill	Not confident at all	Slightly confident	Somewhat confident	Very confident	Extremely confident
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Using effective (i.e., evidence-informed) learning strategies Before	24 (5.3)	25 (5.3)	31 (5.5)	12 (3.9)	8 (3.3)
Using effective (i.e., evidence-informed) learning strategies Now	8 (3.4)	22 (5.1)	26 (5.2)	25 (5.2)	20 (4.9)
Using the internet for finding effective (i.e., helpful) learning strategies Before	20 (5.0)	18 (4.6)	36 (5.8)	19 (4.7)	7 (3.1)
Using the internet for finding effective (i.e., helpful) learning strategies Now	10 (3.9)	10 (3.6)	29 (5.5)	32 (5.8)	19 (4.9)
Using offline learning resources (e.g., textbooks, study/revision guides) Before	17 (4.7)	17 (4.6)	30 (5.4)	27 (5.5)	10 (3.6)
Using offline learning resources (e.g., textbooks, study/revision guides) Now	10 (3.8)	9 (3.3)	24 (5.1)	35 (5.8)	22 (5.1)
Studying on my own outside of school (i.e., doing work other than homework) Before	21 (5.1)	26 (5.3)	17 (4.5)	24 (5.1)	12 (3.9)

Study skill	Not confident at all	Slightly confident	Somewhat confident	Very confident	Extremely confident
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Studying on my own outside of school (i.e., doing work other than homework) Now	8 (3.3)	12 (3.9)	27 (5.4)	32 (5.7)	21 (4.8)
Revising on my own in preparation for class tests, external exams at home Before	21 (5.0)	20 (4.9)	30 (5.5)	20 (4.9)	10 (3.5)
Revising on my own in preparation for class tests, external exams at home Now	10 (3.5)	10 (3.5)	25 (5.3)	34 (5.8)	21 (5.0)

Table C 2. *Weighted percentage scores for learner responses to the survey question, “During the COVID-19 school closures, how helpful was the support you received from your school for the following aspects of home learning”?*

Learning activity	Not at all helpful	Somewhat helpful	Moderately helpful	Very helpful	Extremely helpful
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Using your school’s digital learning platform	13 (4.3)	24 (5.3)	41 (6.1)	16 (4.4)	7 (3.0)

Learning activity	Not at all helpful	Somewhat helpful	Moderately helpful	Very helpful	Extremely helpful
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Using other online platforms such as Google Classroom, Microsoft teams to access schoolwork and/or communicate with your school teacher(s)	4 (2.3)	18 (4.7)	36 (5.9)	22 (5.4)	20 (5.0)