



Department  
for Education

# **Numeracy skills interventions for adults (19+): A systematic review of the evidence Summary**

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**Authors: Alma Economics**



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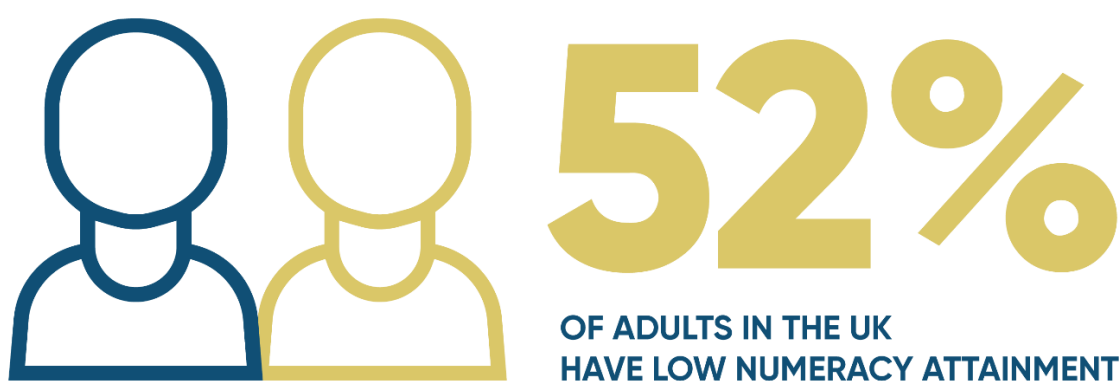
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# Executive Summary

## Introduction

Over the last 20 years, numeracy skills have been a key focus of adult skills policy both globally and in the UK. This focus has been driven by the links that have been observed between levels of adult numeracy skills and life outcomes for individuals, including improved employment outcomes, self-confidence, social integration, and career progression. Improved numeracy skills can also generate wider benefits for the employers of adult learners and for the economy due to increased productivity, alongside other effects.



Source: Understanding Society 2020, respondents specifying if they had an O level or GCSE grade A\*-C or equivalent in Maths

This systematic evidence review has synthesised the evidence base for interventions intended to improve numeracy skills among adults with below Level 2 qualifications in Maths. This research aims to inform the development of policy in this area as part of the UK government's Multiply programme.<sup>1</sup> It will also inform the decisions of practitioners and local providers of adult numeracy services.

This review addresses the following research questions:

- i) What lessons can be learnt from adult skills policy in this area over the past 20 years?
- ii) What is known about adults (19+) in the UK who have limited numeracy skills (below Level 2)?

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<sup>1</sup> <https://www.gov.uk/government/news/multiplying-maths-skills-for-adults>

- iii) Which approaches appear to be the most and least successful in supporting different groups of adults to improve their numeracy skills, up to and including Level 2?<sup>2</sup>

Approaches to improving numeracy skills among adults are diverse. Differences in these approaches include:

- Which groups of adults are targeted, and how they are recruited for, and encouraged to persist in, learning;
- How and where courses are delivered;
- Which teaching practices are used and how courses are designed and structured;
- How adults with additional support needs are supported to improve their skills.

In each of these areas, this review has identified promising practices in the literature, as well as gaps where the evidence base is insufficiently robust or mixed. To identify the areas where evidence is stronger, we have implemented a scoring system for every academic or grey literature source we reviewed. The score given is a composite of the quality and relevance of the evidence in each source for answering this report's research questions. Appendix A presents the scale used when assessing the quality and relevance of studies.

A key finding of this review is that adult learners are an exceptionally diverse group with diverse needs, so there is no one-size-fits-all solution. However, the findings of this report can help guide the design of future initiatives by highlighting interventions that appear to have been successful in the past and exploring the factors behind their success.

## **The evidence base**

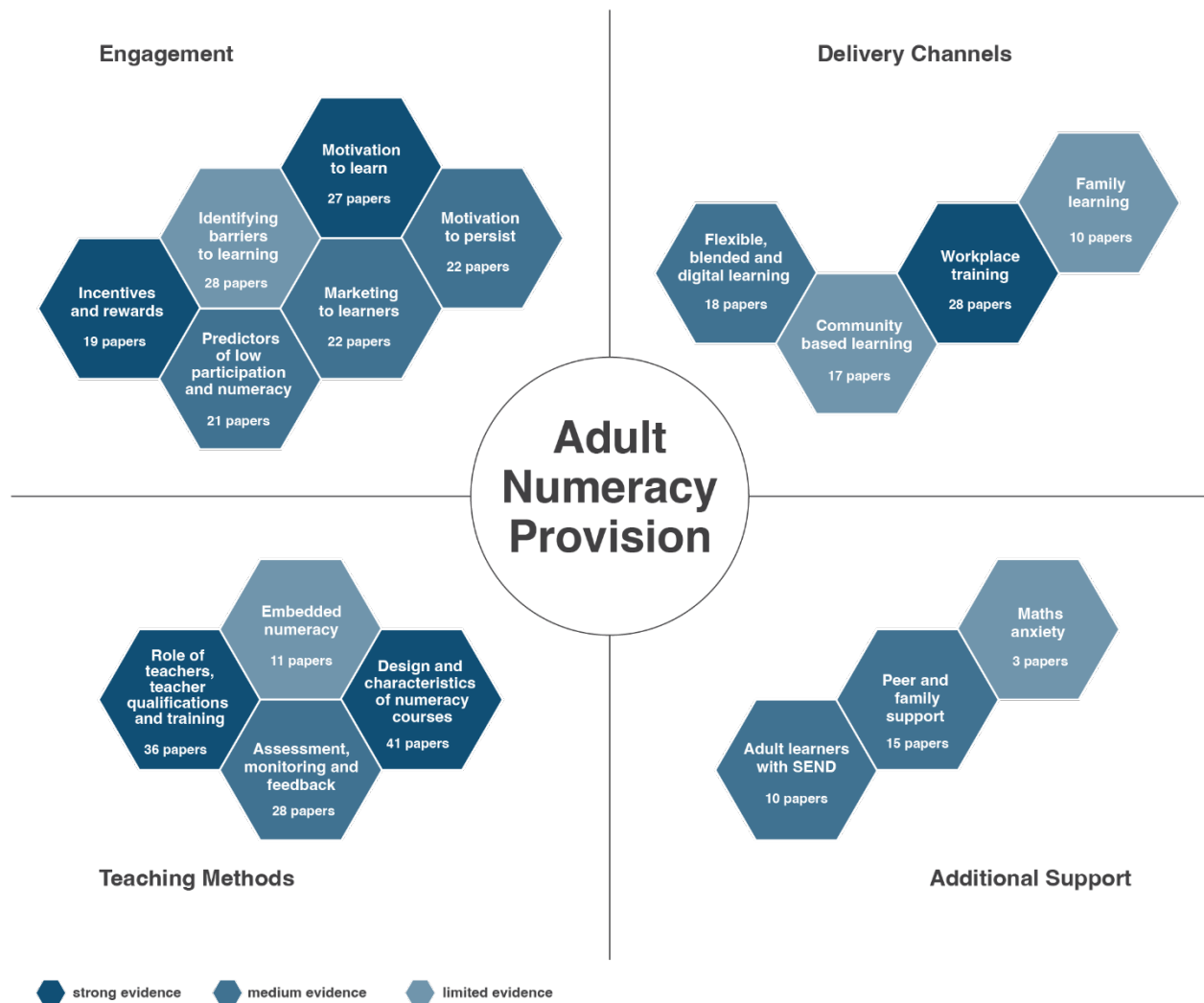
The evidence review included a total of 209 studies<sup>3</sup>. Most of the research identified was in the form of small case studies, while impact assessments of specific interventions were usually based on surveys and interviews with participants, administrative data from courses, and completion and qualification attainment data. Across all themes, some studies used high-quality experimental or quasi-experimental methods to test hypotheses and the impact of specific interventions. However, these studies were in the minority. Further, they often referred to interventions that are very specific in nature and they were sometimes based on very small samples. Other existing studies evaluated larger initiatives, followed groups of learners over time, or considered national data. Overall, the quality of the evidence discussed in this review is mixed. In many cases, context is vital for understanding the strength and generalisability of results.

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<sup>2</sup> Level 2 qualifications include GCSE Grade 4+ in England, GCSE Grade C or above in Wales and Northern Ireland, or Scottish National 5 as well as a range of other qualifications such as level 2 functional skills qualifications or an intermediate apprenticeship - <https://www.gov.uk/what-different-qualification-levels-mean/list-of-qualification-levels>.

<sup>3</sup> For the interactive evidence map, see: <https://multiply.evidencemap.com/>

# How much evidence is there about adult numeracy?



The literature reviewed in this report is broken down into four broad sections: engagement, delivery channels, teaching methods, and additional support. Section one on engagement covers the literature related to identifying adults that struggle with numeracy and how best to motivate them to sign up for, and remain in, skills courses. Section two on delivery channels covers literature concerning where and how material is presented to learners and addresses topics such as workplace learning, community learning, and hybrid learning. Section three on teaching methods covers literature on theory around teaching adults and teaching mathematics as well as what is considered most effective in the field. Finally, section four covers literature on additional support – specifically, the most effective ways to support learners with learning difficulties, maths anxiety, or family and care responsibilities.

A few evidence gaps were identified in each section. Within the area of adult learners' motivation and engagement, the smallest group of studies focused on the use of incentives and rewards to motivate learning, effective communication approaches in the classroom and online, and compulsory attendance. However, within each of these categories there were some high-quality papers with robust methodologies. None of the studies found explored the use of social media for engaging adult basic skills learners. In the delivery channels section, there were fewer relevant studies about the impact of community-based training and family learning. Although the evidence base on teaching practices was the richest across all themes, home learning and how to encourage practice between sessions were not assessed by any study reviewed. The theme of additional support for adult learners with specific needs was the area with the smallest evidence base, with some key evidence gaps identified. Firstly, there was no study addressing the needs of adults with dyscalculia. Additionally, evidence on support for adult learners with SEND and learning difficulties was focused on the most severe levels of learning difficulties. Finally, the number of papers on support for learners with maths anxiety was extremely small.

## Who are the adults with below Level 2 numeracy skills?

Data is available on adult numeracy skill levels both nationally and internationally. The surveys carried out by the OECD's Programme for International Assessment of Adult Competencies (PIAAC) are the best-known example. These provide valuable information on numeracy skill levels in the general population. While PIAAC numeracy scores for England are in line with OECD averages, 24.1% of adults scored at or below Level 1 in the PIAAC, indicating that a significant proportion of the population lacks basic skills. However, these figures may obscure significant regional or local variation in skill levels (University of Exeter, 2002). In addition, the survey is infrequent, with the most recent PIAAC dataset including data collected in 2017 and the next wave to be released in 2024. Consequently, this report utilises data from the UK's Understanding Society (UKHLS) survey to supplement our understanding of numeracy skill levels among adults.

Around half of UK adult respondents in the Understanding Society survey reported that they have achieved a Level 2 numeracy qualification at some point in their life, though this does not necessarily reflect their current numeracy skills' level. The likelihood of having a Level 2 or higher qualification varies by a range of characteristics including age, gender, and income. We found that adults who are white (48%)<sup>4</sup> or mixed-race (50%), are employed (50%), or have higher incomes are more likely to have Level 2 or higher numeracy qualifications than adults who are black (41%) or Asian (38%), are older (67% of those aged 20 – 24 versus with 39% for those aged 55 – 65), are unemployed (41%) or have lower income (e.g. 49% of those earning £20,000-£24,999 per year versus 61% of those earning £35,000 or more per year). In addition, adults with below Level 2

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<sup>4</sup> The parentheses show the percentage of adults in each group who have achieved a Level 2 or higher qualification in numeracy.

numeracy qualifications were highly likely to report that they did not have Level 2 literacy qualifications either and to engage less with technology than the average respondent.

## Engagement

One of the challenges faced by many adult learning programmes is identifying and recruiting adults. This involves understanding why adults may be motivated to improve their skills, as well as the barriers that may prevent them from doing so.

Individuals are less likely to participate in adult learning if they are older, have young children, are lone parents, have no qualifications, or have low social status (Hall et al., 2021; Metcalf, 2009). As a result, the target participants for many numeracy skills programmes are individuals who are less likely than average to participate in such programmes. This problem is compounded by the fact that adults may lack awareness of their own skill levels. Individuals may use coping mechanisms to avoid using maths in their everyday life, or may not know what skills they don't have (Carpentieri et al., 2009; Cieslik & Simpson, 2009).

Adults who do participate in numeracy skills programmes have a range of motivations for doing so. These include supporting their children, pursuing professional opportunities, and an intrinsic desire to gain skills or complete 'unfinished business' in formal education (see e.g. Atkin, 2010; Carpentieri, 2014). However, adults may be deterred by barriers including health, family or work commitments and a lack of knowledge of available provision (see e.g. Maclachlan & Tett, 2006; Windisch, 2016).

When enrolled in courses, adults may still drop out without improving their skills. Learners are more likely to drop out near the start of courses, and learners with prior qualifications are less likely to drop out (Vorhaus et al., 2011). Learners report that the decision to leave a course is more likely to be driven by life events than the course content. Support from peers, families and employers can all encourage learners to carry on with courses (see e.g. Joseph et al., 2017; Kane et al., 2007).

In response to these challenges, several approaches have been found to be effective in encouraging participation and persistence among adult learners, including:

- Taster courses to demystify adult education for potential learners (Stevenson et al., 2021);
- Buddying arrangements within classes and the use of encouraging text messages for learners (Hume et al., 2018);
- Convenient learning locations (such as centres in the community or in places with good transport links) with support to address issues such as transport costs or childcare needs (MacLeod & Straw, 2010);

- Using digital tools to provide flexibility and keep learners engaged (Learning and Work Institute, 2019);
- Linking course content directly to learners' personal goals (Westwood, 2021).

Learners were more likely to sign up for, or seek more information about, a numeracy course if they heard about it from a family member, friend, or other individual they trust (Barnes et al., 2003; Woodhouse & Stevenson, 2018). Learning champions – former learners that have successfully completed courses – can be another effective outreach asset to raise awareness and promote recruitment, as they can showcase the merits of courses and act as role models within their communities (Stevenson et al., 2021). Many adults also stated that they had heard about a course or numeracy programme from television, radio, or another national campaign. The Department for Education and Skills (DfES) 'Gremlin' campaign and the national media campaigns 'Move On' and 'Get On at Work' raised awareness of skills education among some adults (Further Education Trust for Leadership 2021). Media and especially TV are effective communication and marketing tools, as the target audience of adults is more likely to watch TV than to read flyers or written materials (Beadle et al., 2015; CRG Research, 2002). Moreover, one-stop career centres can successfully overcome informational barriers, particularly when it comes to minority groups. These can streamline information and limit bureaucracy, allowing for easier engagement of prospective learners (European Commission, 2003; Peterson et al., 2002).

Factors that support successful engagement campaigns include:

- Partnering with community and voluntary sector organisations to reach learners through existing support networks (Hall et al., 2022);
- Using learning champions to leverage word of mouth (Stevenson et al., 2021; UIL, 2015c);
- Using “hooks”, such as supporting children with homework, or mastering IT skills, that reflect learners' motivations (HM Inspectorate of Education, 2005).

## Delivery channels

Adult skills courses have been delivered in many ways, partly as a response to the challenges of recruiting and keeping adults on courses. Flexible approaches to provision can theoretically increase accessibility and participation by supporting adults with other commitments to remain engaged.

However, the evidence base on flexible learning as a concept is not very large (Phillips & Smith, 2010) and the term 'flexible learning' has increasingly been replaced by digital and blended<sup>5</sup> approaches to provision. Blended and digital learning is more likely to be

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<sup>5</sup> Blended learning is a style of education that combines learning via electronic and online media with traditional face-to-face teaching.



successful when provision considers the IT skills and access of learners and teachers and uses appropriate materials. Evidence from learners on blended courses shows that personal contact with peers and instructors remains popular, whether in digital or face-to-face settings (Li et al., 2018).

Workplace training has been a common approach to engaging adult learners. It has the benefit of being provided at locations and times convenient to the learner and in an informal and familiar setting for learners. It is likely to be most effective when activities are contextualised with work and real-life activities and where content is tailored so that learners can transfer their learning into the workplace (see e.g. FitzSimons et al., 2005). Further, employer support, sustainable funding and the presence of a culture that values learning are critical and, if absent, can lead to poor outcomes (see e.g. Kersh et al., 2012). Additionally, union representatives and other employee bodies can play a significant role in recruiting learners and designing course content (Chartered Institute of Personnel Development, 2005).

Another way of engaging hard-to-reach learners is to situate training in the community. This can provide learners with a convenient and supportive environment and encourage those with low levels of confidence or learning difficulties to participate. Coordination and communication between local providers and public services such as schools and libraries can support delivery (UIL, 2017a). Evidence suggests that community non-accredited learning can generate beneficial outcomes for individuals. Non-accredited training can be a pathway into accredited courses, provide additional support to learners of accredited courses and contribute to personal and social outcomes of learners such as confidence, resilience, self-worth and connection with family and wider community (Dymock, 2007; Dymock & Billett, 2008; Plant & Stevenson, 2022)

Family learning can be an effective way of engaging parents who are otherwise difficult to recruit to adult learning courses. As well as improving numeracy skills, these courses can strengthen family relationships and parental engagement with children's learning. Family learning courses can make use of a range of approaches including online platforms, home based training (UIL, 2019b), and play activities (Barnes et al., 2003).

## Teaching practice

Teaching and course design play a critical role in the way that learners experience skills courses. There is considerable theoretical literature underpinning adult numeracy teaching. The key recommendations from this literature are that:

- Adult learners are a diverse group whose goals, needs, strengths and weaknesses vary. Compared to children, adult learners are likely to be more self-directed, have more life experiences and want to understand how content is relevant to their lives. Adults in skills courses may already have negative experiences with approaches commonly used with children.

- A holistic view of an individual's numeracy needs should include their use of numeracy skills outside of formal education settings. This will influence the form and content of the material that is best suited to their needs. There is also evidence that practising numeracy skills regularly in real life can consolidate learning. Opportunities to do so will vary among adults.

Some initiatives have embedded numeracy training in other vocational courses. This can be beneficial in overcoming barriers to engagement with numeracy courses, as learners attend while studying towards something else and are then shown the relevance of numeracy skills to other subjects that they care about. Embedded numeracy training works best when courses have been carefully designed so that numeracy content is relevant to the wider course (Casey et al., 2006). This is most likely when practitioners with different areas of expertise work together to design and deliver courses. Students should receive numeracy-specific support, especially if some numeracy content is being delivered by non-specialists.

Whatever the delivery model of a programme, lecturing is unlikely to deliver the best outcomes for adult learners, and, for many, will remind them of previous experiences of education. Rather, reciprocal teaching, where students are encouraged to take the lead and explain concepts as they progress, and group work approaches appear to result in better engagement among adult learners (see e.g. Learning and Work Institute, 2019; Torgerson et al., 2004). One of the strongest research findings is that students find it easier to engage with content that is situated in a relevant context for them, and this context varies from class to class.

The evidence on the optimal duration and intensity of courses is mixed. Intensive courses can help adults make progress more quickly, however, as highlighted, adult learners are likely to have other commitments and may not be able to commit to frequent classes.

Teachers' levels of maths qualifications and overall experience are a predictor of student attainment (Cara & de Coulon, 2008). This likely reflects, at least in part, experienced teachers' ability to adjust content to the needs of a specific group of learners. Research on teacher training emphasises the need for teachers of adult numeracy to develop subject-specific expertise and general skills. Specific approaches such as training teachers in Neurolinguistic Programming (NLP) have been used (Allan et al., 2012), but, in general, few approaches to teacher training have been shown to directly result in better learner outcomes.

An Ofsted report on the provision of direct learning support in colleges found that learners benefitted from teachers having additional support from other practitioners. This could include support tutors working alongside teachers in the classroom or working with individuals with specific needs outside the classroom. In the classroom, support was most useful when it focused on numeracy skills and learner comprehension, and less effective when support tutors were fulfilling roles like correcting spelling or handing out worksheets (Ofsted, 2007). Learners also benefitted from strong, supportive relationships

with their peers and teachers. These experiences can increase learners' social confidence and broaden their horizons (National Centre for Vocational Education Research, 2010).

Given the diversity of adult learners, diagnostic assessments play a crucial role in assessing learners needs and designing appropriate provision to meet those needs. These work best when learners are encouraged to recognise their own prior knowledge and reflect on their own goals and needs (Vorhaus et al., 2011). However, entry diagnostic tests can also be off-putting for those with bad experiences with school and long-term disengagement from education. Looney (2007) presented cases of basic education workshops that conducted welcoming initial interviews, instead of diagnostic tests, as the first step in their assessment process. Additionally, according to Kane et al. (2007), initial diagnostic assessments can be a challenge for learners who often had not been involved in formal learning for some time and might be "mathematically rusty" in some areas rather than lacking knowledge. Consequently, providers must be aware of the potential impact of lack of recent experience in formal education on results as a distinct issue from an actual skills gap.

When reporting on their learning experiences, adults cite a wide range of benefits from learning in addition to skills gained and attainment of qualifications. These include self-confidence, self-efficacy, and family, social and professional benefits. Assessment and feedback should recognise this range of outcomes and can feed back into engagement efforts. Formative assessment builds on diagnostic assessments to monitor learning on an ongoing basis and adjust teaching in response (Looney, 2007). This approach increases persistence and motivation among learners.

## **Additional support**

Some adult learners will need additional support to engage with learning opportunities. In line with the principles outlined above, each adult is likely to have their own mix of needs, strengths, and knowledge gaps. The evidence reviewed for this report concerns: (i) the needs of learners with SEND and maths anxiety, (ii) the impact of peer effects and support among peers, (iii) support for learners with care responsibilities and the impact of family learning, and (iv) the impact of financial support for adult learners.

A small portion of the literature focuses on support for adults with specific support needs, though there are significant gaps, such as approaches to supporting adults with dyscalculia.

For adults with special educational needs and disabilities (SEND) the literature tends to focus on small numbers of adults and specific interventions (see e.g. Gilley et al., 2021; Kellems et al., 2021). Some approaches have been successful in these contexts, but there is limited evidence about how they would generalise to larger groups or learners with different support needs. As with all adults, providing a real-world context for learning

can help, as can the innovative use of digital technologies. Materials need to be adapted to the needs of the learners and teachers should be given support to understand these needs.

Some adults experience maths anxiety as the prospect of using maths causes them significant discomfort. This can be a barrier to improving skills. Maths anxiety is more common in adults who have had a long gap since their last experience of formal education, and often manifests in perceptions that there is a difference between academic and everyday maths (Jameson, 2020). Awareness of psychological barriers is crucial for practitioners who can then explore options to tackle negative self-perceptions, including enrolling adults in courses where they can first build mastery of simple concepts, and assigning peer mentors.

Peer support has been found to be valuable in a wide range of contexts. The most common effects of peer support are on learner engagement and persistence. Peer support can be a formal mentoring-type arrangement or can be encouraged through informal and unstructured activities such as peer experience exchanges. Supportive relationships among learners, group working, and constructive peer pressure have all been found to be effective (Lord et al., 2010). In workplace learning, employees are more likely to be honest and open about challenges with peers than with a manager. Unions can help promote peer support, either from union representatives or by connecting learners with others in a similar position (Finlay et al., 2007 ; Yasukawa et al., 2014).

Families can also play a role in supporting learners, while participating in adult learning can strengthen family relationships (see e.g. UIL, 2012, 2019a). Involving families can strengthen learners' resolve and encourage persistence (Hume et al., 2018), while catering for family responsibilities that learners may have can remove a potential barrier to learning (Barnes et al., 2003).

## **Future research**

Future research applying experimental or quasi-experimental approaches to establish the impact of interventions would be welcome, as such studies were not common in the literature reviewed. Additionally, future research could focus on informing policymakers and the public in areas where there was a gap in the evidence base (e.g. support for adults with dyscalculia, family support for adult learners, home learning, and dual teaching). Furthermore, the impact of the COVID-19 pandemic on delivery methods, teaching practices and learners' outcomes can also be further explored to reveal lessons from the impact of digital learning. Finally, ideas and evidence from other parts of the education and training academic literature may support the design of provision and research in adult basic skills learning, e.g. practices for young people (16-19) or children, or lessons learned from other topics in adult learning (e.g. digital skills training), taking into consideration the expected differences across the populations of interest.

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