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Learning technology in adult English, maths and ESOL/ELT provision: an evidence review

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This evidence review was carried out by the National Research and Development Centre for Adult Literacy and Numeracy (NRDC) at the Institute of Education, London, in partnership with SQW Ltd and the National Foundation for Educational Research (NFER).

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Glossary

ALLN	Adult Language, Literacy and Numeracy
Assistive Technology (AT)	Assistive, adaptive, and rehabilitative devices for people with disabilities
Blended Learning	A formal education programme in which student learns partly through online delivery of content and instruction with some element of student control over time, place, path or pace.
Computer Assisted Instruction (CAI)	(CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. AI programs use tutorials, drill and practice, simulation, and problem solving approaches to present topics, and they test the student's understanding.
Computer Assisted Language Learning (CALL)	A subset of CAI, formerly known as Computer Assisted Language Instruction, CAI refers to a wide range of information and communications technology applications and approaches to teaching and learning foreign languages
Computer-Mediated Communication	Any communication that occurs through the use of two or more electronic devices. CMC can be synchronous (for example, instant messaging, chat rooms and, sometimes, instant messaging) or asynchronous (email, message boards messaging, chat rooms)
Digital Literacy/Literacies	The ability to effectively and critically navigate, evaluate and create information using a range of digital technologies
Digital Native	A person who was born during or after the general introduction of digital technologies and who, through interacting with digital technology from an early age, has a greater understanding of its concepts
ELL	English Language Learners. Non-native English speakers. This term is commonly used in the United States than ESOL/ELT.
ESL	English as a Second Language. The use or study of English by speakers with different native languages. This term is commonly used in the United States than ESOL/ELT.
FELTAG	The Further Education Learning Technology Action Group. Set up in January 2013 by Matthew Hancock, Minister of State for Skills and Enterprise in BIS, its purpose was to make practical recommendations to ensure the effective use of digital technology in learning, teaching and assessment in Further Education and Skills. The FELTAG report was published in March 2014.
Information and Communication Technology (ICT)	Information and communications technology (ICT) refers to all the technology used to handle telecommunications, broadcast media, intelligent building management systems, audiovisual processing and transmission systems, and network-based control and monitoring functions. Although ICT is often considered an

	extended synonym for information technology (IT), its scope is broader. ICT has more recently been used to describe the convergence of several technologies and the use of common transmission lines carrying very diverse data and communication types and formats.
Massive Open Online Course (MOOC)	An online course aimed at unlimited participation and open access via the web.
Moodle	A Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a free web application that educators can use to create effective online learning sites (http://moodle.org)
Quasi-experimental design	An empirical study used to estimate the causal impact of an intervention on its target population but where, unlike in a RCT, there is not random assignment to treatment or control.
RCT	The gold standard in empirical research, Randomised Controlled Trials (RCTs) are intervention studies in which groups receiving the experimental treatment are compared with control groups receiving no treatment, and allocation of the research population to the treatment or control group is random.
Scaffolding	A learning process in which support – in the form of resources, tasks, guidance and so on – tailored to the needs of the student is given with the intention of helping the student achieve his/her learning goals. Scaffolding can also be provided by an expert or someone whose understanding is at a more advanced stage. Such support is gradually removed as students master the skill or acquire the knowledge and so achieve what, unsupported, would have been too difficult for them.
Task Based Language Learning (TBLL)	Students learn the target language by focusing on the completion of meaningful tasks (such as visiting a doctor) and not on the study of a de-contextualised linguistic structure or a list of vocabulary items. The emphasis in TBLL is not on learning the language or form per se, but on engagement in the authentic, pragmatic, contextualized, and functional use of language.
Technoliteracy	Literacy and technology have a close relationship, with much computer assisted communication being mediated through some form of text. This is often discussed under the heading of digital literacy. For Snyder et al. (2005, p. 11) it is “practically impossible in some areas to distinguish the boundaries between literacy and technology so that we now talk about ‘technoliteracy’”.
Virtual Learning Environment (VLE)	A VLE, or learning platform, is an e-learning education system based on the web that models conventional in-person education by providing equivalent virtual access to classes, class content, tests, homework, grades, assessments, and other external resources. It is also a social space where students and teacher can interact through threaded discussions or chat. It can be used in distance learning, or incorporated with a physical learning environment (blended learning).

Executive Summary

This report presents the findings of an evidence review on the value of learning technology to adult English, Maths and ESOL/ELT provision. The review was conducted by the National Research and Development Centre for Adult Literacy and Numeracy (NRDC) at the Institute of Education, London, in partnership with SQW Ltd and the National Foundation for Educational Research (NFER), between February and August 2014.

Aims and method

This review aimed to develop a sound understanding both of (1) the existing evidence on the value of technology to adult basic skills provision and of (2) potential target populations within the adult learner cohort, including an understanding of their current access to and use of technology. To meet these aims, two strands of research and analysis were undertaken: a systematic review of research and a data review on the key populations of interest. The review was explicitly intended to update an earlier review by Torgerson et al. (2004) on effective teaching in adult literacy and numeracy.[1]

Specifically, the review was designed to address four research questions:

1. What does the evidence-base now tell us about the value of using technology-rich approaches in adult literacy, numeracy and ESOL/ELT delivery?

2. What principles should inform the choice of and use of technology in adult skills delivery?

3. How does current engagement with technology vary between different populations of interest? In particular, how does it vary for those who are unemployed compared to the employed, and for young people compared to older age groups?

4. How large are the following possible groups of interest at present: Apprentices, other employed learners, those claiming Job Seekers Allowance?

The evidence base

Through a systematic document search and screening process, a total of 27 English-language sources were included in the review. These included seven evidence reviews and 20 primary research studies, the majority (14) of which adopted single (6 quantitative studies and 8 qualitative) rather than mixed-method approaches (6). Six of the 20 research studies focused on adult literacy learners, three on adult numeracy learners, seven on adult ESOL/ELT learners, and four on learners of more than one basic skill.

The evidence base was small, suggesting that, despite the increased use of ICT in education and in daily life, very little high quality research related to the effectiveness of

[1] The Torgerson review did not look at the teaching of ESOL

using technology in adult basic skills delivery has been carried out, either in the UK or internationally. Short reviews of the literature available in the German and French languages also identified only a small and patchy evidence base.

The heterogeneity of the evidence base meant that it was not possible to consolidate the review's findings by type of technology, or to make comparisons between different types of technologies, or to calculate effect sizes.

Findings

RQ1: What does the evidence-base now tell us about the value of using technology-rich approaches in adult literacy, numeracy and ESOL/ELT delivery?

The evidence base contained limited findings about the value of learning technology as evidenced in learning gains. As in Torgerson et al. (2004) there were indicative findings of literacy gains made by prisoners (in this case using text to speech software). In numeracy, two quantitative studies (one Canadian, one American) reported gains to numeracy learners; the first reported only for more basic maths; in the second the gains seem related to the implementation mode (in this case via collaborative learning). This highlights the importance of social aspects of learning; there is an assumption in the literature that face-to-face contact between learners and teachers and learners and their peers has an important role to play. There is very little in the research that looks at whether similar social supports could be offered in an online environment. This is as an area that would benefit from further research.

The evidence on ESOL is more extensive, and may reflect a wider interest in the use of technology with language learning other than ESOL. Three studies were found where ESOL learners using technology experienced greater gains in, respectively vocabulary, in oral fluency, and in communication, although each study was small and with limits to its design.

There was also interesting if limited evidence on use with learning disabilities. The fact that small scale studies could find gains argues that it would be worthwhile to produce larger studies.

Some of the hypotheses that underpinned the research questions considered by this review could not be tested from the current evidence base. There was no evidence from mandated provision. As is the case with research on the effectiveness of adult basic skills more generally, there is a dearth of cost-benefit analysis. We would reiterate the call from our review of research and evaluation on improving adult literacy and numeracy skills (Vorhaus et al, 2011) that more of this be done.

Several studies considered the impact of the intervention on students' motivation to learn and some the impact on engagement levels; the evidence here is encouraging. Although the studies are small, there is a consistent message that technology can motivate learners with basic skills needs across all subject areas. Where evidence is lacking is in how that motivation leads to concrete learning outcomes.

The research to date, while examining students' and teachers' views of the impact from a personal point of view, fails to make use of programmatic and administrative data. Learner retention was unexplored, as were learning hours.

RQ2: What principles should inform the choice of and use of technology in adult skills delivery?

Given the heterogeneity of the evidence base, and of the adult learner body, the scope for drawing general principles for the educational use of ICT with basic skills learners is limited. However, it is possible to identify from the evidence a number of relevant questions concerning the choice of **technology** and its **implementation** as part of a learning programme.

These questions provide a framework for the analysis of learning technology interventions with this particular group of learners. Such a framework will be of use in understanding and comparing interventions using different technologies and implementation processes. We can group factors under two headings: technology and implementation.

Technology

- To what extent is the chosen technology sensitive to the different ICT skills of learners, and to the differences in experiences and attitudes between younger and older learners?
- To what extent does the chosen technology enable learning to be tailored to the needs of the individual?
- To what extent is the chosen technology blended with traditional forms of instruction?
- To what extent does the chosen technology allow for, or facilitate, learning situated in real world practices?
- To what extent does the chosen technology effectively scaffold learning?
- To what extent does the chosen technology encourage collaboration between students?

Implementation

- What is the role of the teacher?
- Do teachers have the skills and knowledge that they need?
- How effective is induction in preparing students for learning?

RQ3: How does current engagement with technology vary between different populations of interest? In particular, how does it vary for those who are unemployed compared to the employed, and for young people compared to older age groups?

A number of studies reported on the different levels of engagement that might be experienced by learners of different ages, where age was equated with either ICT skills level or the extent to which digital technologies were integrated into individual lives. Here the message was clear: different strategies will be required to engage these different populations of interest, and engaging older learners is likely to prove the greater challenge.

Three studies in the evidence base offered conclusions on the relationship between existing ICT skills or ICT confidence and the effectiveness of the intervention. However, the evidence was inconclusive; one quantitative study found no relationship but the other studies offered lower quality evidence that existing skills were a factor.

RQ4: How does current engagement with technology vary between different populations of interest? In particular, how does it vary for those who are unemployed compared to the employed, and for young people compared to older age groups?

From a policy perspective, identifying the potential scale of the populations of interest is currently problematic. Most publicly available data is collected and distributed for a particular purpose, whether administrative or accountability, rather than to provide insights into the detailed demographic profile of claimants. Some of the datasets (such as the Census, the DWP data on Job Seekers Allowance, data from the SFA and BIS on Adult FE & Skills, Apprenticeships and Workplace Learning and the BIS Skills for Life Survey) provide useful information about some populations, but would require additional analyses to be undertaken, or additional data to be collected, in order to provide the detailed information needed to calculate the size of the populations who would most benefit from the use of technology-rich learning environments.

Conclusions

We can conclude that the evidence base has changed little since Torgerson et al. (2004). What evidence there is, is localised, and often focused on very specific groups of learners with specific concerns or circumstances. It is difficult to apply lessons from other contexts due to the diversity of the adult learner body, the specific needs of adults with poor basic skills, the different starting points/educational backgrounds of adult learners and the diversity of contexts and supporting infrastructures in which adult basic skills learning takes place.

We do know a lot about how adult learners learn, but not much about how adult learners learn with technology. We also know a lot about how technology is used in learning, but very little about how technology is used is adult basic skills learning.

We need to understand more about how learning technology is currently used with adult literacy, language and numeracy learners before taking steps to ensure that research is undertaken to inform the implementation of a strategy for the employment of learning technology to support adult literacy, language and numeracy learning. The lack of high-quality evidence prevents us from drawing any firm conclusion as to whether increased use of learning technology with adult literacy, language and numeracy learners leads to improved outcomes for these learners.

A scoping exercise is needed to find out, in the UK at least, whether this is because ICT is being used and is under-researched (perhaps because changes in technology are so rapid that research to assess its impact takes too long), or whether it is because traditional forms of teaching are still dominant. The framework for analysis of learning technology interventions suggested here should be used in such research to allow for principled comparison between interventions using different technologies and implementation processes.

1. Introduction

This report presents the findings of an evidence review on the value of learning technology to adult English, Maths and ESOL/ELT provision. The review was conducted by the National Research and Development Centre for Adult Literacy and Numeracy (NRDC) at the Institute of Education, London, in partnership with SQW Ltd and the National Foundation for Educational Research (NFER), between February and August 2014.

1.1 Background

1.1.1 Policy context

Since the publication of the Moser report (DfEE, 1999) on improving literacy and numeracy the expectation has been that ICT would have a vital role to play in the drive to improve basic skills. It was thought that ICT had the potential to provide exciting and attractive learning opportunities, to give learners access to the best materials, to remove barriers and to bring learning into the home. It was felt that for adults who had struggled in compulsory schooling, technology-rich provision would appeal by breaking associations with previous poor experiences in the formal classroom. At the same time, adults' digital skills, increasingly necessary in the workplace and in daily life, would be enhanced.

Early research by Mellar et al. (2001) provided a general picture of the use of ICT in adult literacy, language and numeracy (ALLN) classrooms. Despite noting some positive practices, Mellar suggested that in the years prior to the 2001 introduction of Skills for Life (the national strategy in England for improving basic skills), the impact of ICT on ALLN was limited. In 2004, the English government announced that ICT would become the fourth Skill for Life alongside literacy, language and numeracy[2]. However, the announcement was not followed by the allocation of new funds, or the identification of national targets. Nor was it followed by a systematic attempt to collate evidence on the effectiveness, cost-effectiveness or benefits of the learning technology adopted.

As computer use and Internet access grows, the need to develop a solid understanding of how learning technology can be harnessed to improve the outcomes of adult basic skills learners is critical if government-based policies and initiatives in this area are to be grounded in evidence. Moreover, the UK government has adopted a policy of "digital by default" (Cabinet Office, 2013) in the provision of a range of public services. The digital by default strategy involves moving from offline services to digital services that are so straightforward and

[2] The European Union identified ICT as a basic skill as early as 2000. The Lisbon Council highlighted the need to adapt European education and training systems in order that they meet the needs of the knowledge economy.

convenient that all those who can use them will choose to do so whilst those who cannot use them are not excluded[3].

There is wide cross-sector policy interest in the Department for Business, Innovation and Skills (BIS), the Department for Work and Pensions (DWP) and the Department for Education (DfE) in the use of learning technology in learning. The Further Education Learning Technology Action Group (FELTAG), for example, reporting to Matthew Hancock, then the Skills Minister, in March 2014, made a number of practical recommendations aimed at ensuring the effective use of digital technology in learning, teaching and assessment in Further Education and Skills. FELTAG's report emphasised the importance of enhancing knowledge in the sector of the potential of learning technology. Published in June 2014, the government's response to this report set out the government's strategy for removing obstacles that have impeded the ability of providers in the sector to take full advantage of learning technologies[4].

The government is currently developing a number of initiatives in this area, including pilots and demonstration projects. One aim is to target initiatives at specific cohorts within the diverse body of adult learners. For example, in February 2014, the Deputy Prime Minister announced a pilot project for young job-seekers (aged 18-21) in which mandatory training using predominantly online learning and assessment will be offered to those who lack a GCSE grade C in English and in Maths[5].

1.1.2 Internet use and ICT skills of individuals

Data on Internet and ICT use is available from a number of sources, including the Office for National Statistics (ONS)[6], Eurostat (which uses the ONS data)[7] and the Labour Force Survey. The data from these various sources indicate that most adults in Great Britain have home access to the Internet (83% of the population in 2014), via home broadband (only one per cent of households use dial-up connections); and that access via mobile phones has more than doubled between 2010 and 2014 (from 24% to 58%)[8].

Daily use of the internet has also more than doubled since 2006 (when directly comparable records began) to 38 million adults (76% of the population) in 2014. Although there are age differences, with greater use amongst the 16 to 24 year olds (99%) than those aged over 75 (37%), there is a growing daily use amongst

[3] See https://www.gov.uk/government/publications/government-digital-strategy/government-digital-strategy#executive-summary
[4] See https://www.gov.uk/government/publications/further-education-learning-technology-action-group-feltag-recommendations-government-response
[5] Nick Clegg, speech at Southfields Academy: Better Choices, Better Prospects: Helping All of Our Young People Succeed. Available at: https://www.gov.uk/government/speeches/better-choices-better-prospects-helping-young-people-succeed
[6] The ONS uses the Internet access of Households and Individuals in Great Britain via the Opinions and Lifestyle Survey.
[7] See Internet Usage by Households and Individuals (http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-SF-12-050). The take-up of broadband is a key ICT policy-making indicator for the European Commission.
[8] See http://www.ons.gov.uk/ons/dcp171778_373584.pdf

those adults aged 65 and over (9% in 2006 and 42% in 2014). Regional and gender differences are evident, with greater use in London (90%) than Northern Ireland (79%) and a higher proportion of men (89%) than women (85%) making regular use of the internet. These gender differences are, however, less evident amongst users under 65[9].

Usage includes social media (91% of adults aged 16 to 24 have used social networks), practical applications (in 2014, 74% of all adults bought goods or services online, up from 53% in 2008) as well as job searches. Indeed, as the 2013 ONS data showed, two thirds (67%) of unemployed adults had looked for a job or submitted a job application online, while just over half of unemployed adults (54%) reported that they had looked on the internet for information about education, training or courses.

These data cannot be interrogated in depth in relation to the language, literacy, or numeracy skills of all responding individuals. However, we know that the perception of many of those who were unemployed at the time of the ONS survey was that their computer skills were sufficient if they needed to start a new job, even if they were less confident than their peers in employment (67% compared to 72%). Nonetheless, we cannot interrogate this data (whether ONS or LFS) to explore the relationship between their levels of ICT confidence and their language, literacy, or numeracy skills. We know, via the data collected for Eurostat, about the extent to which respondents had used particular ICT skills (such as moving or copying folders, using spreadsheets or writing computer programmes), but we do not have data on their wider literacy or numeracy skills.

There is evidence, however, that adult basic skills learners are more likely to be on the wrong side of the “digital divide”, that is, the gap between those individuals and communities that have, and do not have, access to the information technologies. Research by Parsons and Bynner (2007, cited in Carpentieri, 2010) using data from the British Cohort Study found a worrying digital divide between adults who had good basic skills and those whose basic skills were poor, with the former much more likely to have access to and use computers and the Internet. It is notable that, of the 17% of the population that have no access to the internet, one in three said this was due to a lack of skills[10]. The poorer an individual’s numeracy skills, the less likely he or she was to have and/or use a computer or the Internet. This relationship was consistent across genders – and each successive level of poorer numeracy skills was associated with less use and access to computers and the Internet.

1.2 Aims

The overall aim of BIS (hereafter referred to as “the Department”) in commissioning this evidence review was to develop a sound understanding of which learning technologies are being used in adult English, maths and ESOL/EFL provision, how this technology works and who it works for.

[9] See http://www.ons.gov.uk/ons/dcp171778_362910.pdf
[10] See http://www.ons.gov.uk/ons/dcp171778_373584.pdf

The review was explicitly intended to update an earlier review conducted by NRDC (Torgerson et al., 2004) on effective teaching in adult literacy and numeracy[11]. This earlier review considered only evidence from Randomised Controlled Trials (RCTs) and Controlled Trials (CTs). It also reported on the subjects of adult literacy and numeracy together rather than separately. Torgerson et al. found three relevant RCTs with which to address their research question, "*What evidence is there that ICT enables adults to make better progress?*" Meta analysis of two (both from the United States and both studies of prisoner education) found no benefit of ICT over conventional instruction.

The current review aimed to develop a sound understanding both of (1) the existing evidence on the value of technology to adult basic skills provision and of (2) potential target populations within the adult learner cohort, including an understanding of their current access to and use of technology.

1.3 Research Questions and Hypotheses

Specifically, this evidence review was designed to address four research questions.

Questions 1 and 2 focused on evidence of the effectiveness of using learning technology in adult basic skills provision:

1. What does the evidence-base now tell us about the value of using technology-rich approaches in adult literacy, numeracy and ESOL/ELT delivery?

2. What principles should inform the choice of and use of technology in adult skills delivery?

In conceptualising these questions, both "value" and "technology" were interpreted broadly. The review naturally searched for evidence of cost-effectiveness, but value was defined to include a range of possible outcomes including gains in skills and attainment, improved learner engagement, motivation, attendance and retention, as well as the wider benefits of learning. The review aimed to gather evidence on a broad range of learning technologies, on the understanding that the specific technologies/products might be outdated but that the broader messages on technological approach could be of merit.

Questions 3 and 4 focused on evidence about populations of interest to the Department within the current or potential cohort of adult basic skills learners.

3. How does current engagement with technology vary between different populations of interest? In particular, how does it vary for those who are unemployed compared to the employed, and for young people compared to older age groups?

[11] The Torgerson review did not look at the teaching of ESOL; it also had a broader remit that the current review, examining a wide range of educational interventions, not solely ICT interventions.

4. How large are the following possible groups of interest at present: Apprentices, other employed learners, those claiming Job Seekers Allowance?

Not only was there a need to explore the research evidence in relation to how different groups of people approached and used technology, there was a need to explore the published data on each of the groups of interest in order to indicate the possible scale of any technology-rich interventions that might be needed.

The four research questions were framed by the Department with the aim of testing eight interlinked hypotheses:

1. Technology-rich delivery of adult English OR adult maths OR adult ESOL/ELT learning is more cost-effective for all or some types of learners than learning where the primary interface is face-to-face with a teacher or facilitator.

2. Technology-rich delivery improves learning outcomes when compared to traditional forms of delivery by increasing retention in learning through offering flexibility to learn at more convenient times for the learner and/or extend the amount of time learners are learning.

3. Technology-rich delivery improves learning outcomes when compared to traditional forms of delivery by increasing students' motivation to learn.

4. Technology-rich delivery improves learning outcomes when compared to traditional forms of delivery by increasing students' motivation to learn, even where their participation is mandated.

5. Technology-rich delivery improves engagement, particularly for young adults, because it provides immediate feedback and re-enforcement.

6. Technology-rich delivery improves retention, particularly for young adults, because it provides immediate feedback and re-enforcement.

7. Technology-rich delivery varies in effectiveness for different learners depending on their pre-existing familiarity with the technologies involved.

8. The cost-effectiveness of technology-rich learning varies depending on the type of delivery (adult English, maths or ESOL/ELT) independently of pre-existing familiarity with technology.

In defining the review's scope and objectives, the Department and the research team were aware that the availability of high-quality research was likely to be limited and that not all the research questions and hypotheses could be addressed by the evidence base.

1.4 Method

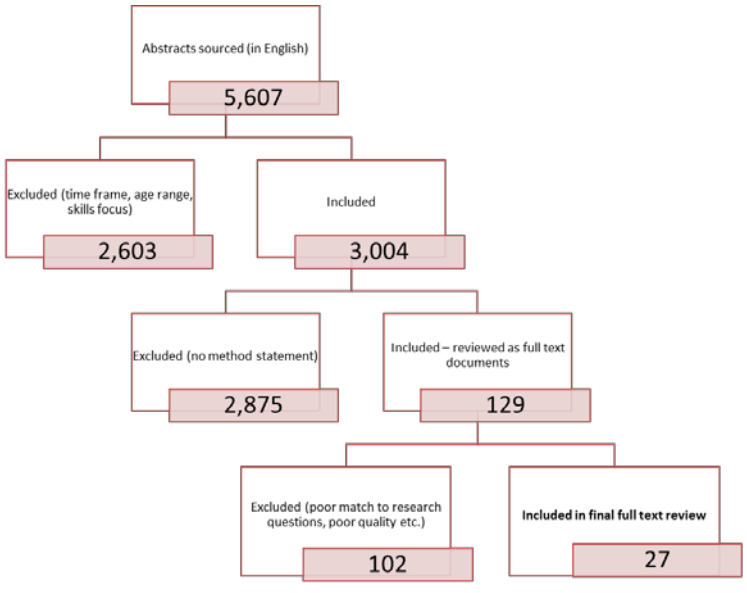
This study comprised of two linked strands: (1) a systematic evidence review of English-language sources on the value of using learning technology with adult basic skills learners, and (2) a data review providing information on the size of the populations that could benefit from the use of a technology-rich environment. These elements were enhanced by short, non-systematic literature reviews of French and Germany-language sources. Full details of the methodology adopted are included in Annexes B1, B2 and B3.

1.4.1 Evidence review

The search strategy comprised a series of search terms and sources, derived by matching database keywords to all of the research questions[12]. The keywords aimed to identify literature on the potential value of technology-rich approaches to adult English, maths and ESOL/ELT learning, and their possible application to certain target populations. The search drew on four types of sources: bibliographic databases, websites of key organisations and institutions, reference harvesting of key documents, and publication lists of subject experts.

A trial search was carried out to test the search terms and, on completion of the searches, the results were imported into Eppi-Reviewer 4[13]. Once duplications were removed this left 5,607 abstracts for review. As a large volume of reports was generated, an initial screening approach was used to reject literature outside the scope of the review (see Figure 1-1).

Figure 1-1: Documents included/excluded at each stage of the process[14]



[12] The overall parameters and strategies for searching, selecting and retrieving documents for review were set out and agreed with the Department.
[13] EPPI-Reviewer 4 is software for systematic reviews developed and maintained by the EPPI-Centre at the Social Science Research Unit at the Institute of Education, University of London.
[14] English language reviews only.

This screening included (1) time frame (pre-2002 studies were excluded); (2) language (studies not published in English were excluded); (3) age of population (studies focusing on children 0-15 were excluded); and (4) skills set (studies focusing on solely on higher education, higher level subjects (L3+) and on teacher training or pedagogy were excluded).

3,004 document abstracts were subsequently taken through a further series of exclusion and inclusion criteria concerned with the study purpose and study methodology. Abstracts that did not clearly mention or discuss a study's methodology were excluded, since no judgement could be made about research quality. Abstracts in which no direct relevance to the review's research questions or hypotheses was found were also excluded. If relevance could not be fully ascertained from the abstract, the sources were retained within the shortlist until the next review stage.

The second shortlist comprised of 129 documents. Full texts were sourced and taken through a screening review using another set of exclusion and inclusion criteria (see Figure 1-2)[15]. This stage allowed the recording of descriptive fields such as methodology and source of evidence, as well as reviewers' assessments of the methodological quality of studies in relation to the key research questions.

Figure 1-2: Screening review fields

• Type of research • Research focus • Population • Geographical coverage • Basic skills focus? • Learning technology used • Method quality	• Method details and characteristics • Source of evidence • Sub group of population • Delivery setting • Intervention • Outcomes

The 27 documents that remained after this third filtering process were taken through a full and complete review and form the basis of this report. A bibliography of these sources is provided in Annex A1 of this report and a detailed summary of each source in Annex A2. Each of the documents included in the full review was coded for relevance to the study's research questions (first order concepts) using Eppi-Reviewer. These findings were then grouped according to characteristics, for example, according to learning subject or population of interest. In the final stage of analysis, messages relevant to the study's research questions and hypotheses were drawn out.

[15] Where documents could not be retrieved (n=26), internet searches for additional information were undertaken; this led to nine sources, which focused on school students in compulsory education (that is, up to age 16), being excluded. A further seven sources were theses in university libraries, or monographs, that could not be accessed within the timeframe of this study.

1.4.2 Foreign language reviews

The German language review was undertaken by Beate Bowien-Jansen from DIE, the German Institute for Adult Education, and the French review by Tatiana Codreanu from ICAR Laboratory in Lyon. Both consultants were briefed by NRDC on the study's research questions and issued with the English-language search terms used in the main document review. The German-language review is appended in full in Annex C1.

1.4.3 Data review

The aim of the data review was to provide information on the scope and scale of the population that could potentially benefit from the use of a technology-rich environment. The populations of interest (as set out in the research questions above) were reviewed with DWP, DfE and BIS and a new list was agreed with the Department, following which an initial search was conducted of relevant datasets and websites. These included the DWP tabulation tool, the Data Services website and the ONS site as well as a general website search.

The data search focused primarily, but not exclusively, on publically available data for the following key groups and sub-cohorts:

Table 1-1: Key groups and sub-cohorts used in the data search

Key Groups	Sub-cohorts
Adult Learners Job Seekers Allowance Claimants	Age (all ages, but with particular interest in the 16-18 range where it was possible to break down the data to look at this group) Gender Skills Level (Level 2 or below) Subject (Literacy, Numeracy, ICT and ESOL) Lone Parents

A list of 40 datasets from nine sources was compiled (see Annex B4); this list was reviewed by members of the Steering Group (which included representatives from BIS and the DfE) and specifically by the Department for Work and Pensions to check for any missing data sources or for data that might be held but was not available in the public domain. No additional sources were identified or added to the original list at this stage.

In addition to the initial populations agreed with the Department and/or identified during website searches, the evidence review was used to ascertain whether there were any additional key groups that might be of interest. This led to the addition of the prison population to the data review.

The data available was then mapped to provide an overview of each database and to determine what could (and could not) be said about the populations of

interest. Where relevant and available, datasets were analysed to determine the size of each population of interest.

1.4.4 Expert panel

A four member expert panel assisted with the search strategy and document search, and commented on the list of studies included in the full review. The expert panel comprised of Professor Emeritus Greg Brooks (University of Sheffield) and Professor Carole Torgerson (Durham University), co-investigators on the earlier systematic review; Professor Diana Laurillard, Professor of Learning with Digital Technologies at the Institute of Education; and Susan Easton, lead on digital inclusion and learning at the National Institute for Adult and Continuing Education (NIACE).

1.5 About this report

Chapter 2 describes the evidence base, its scope and its limitations.

Chapter 3 reports findings addressing the first research question on the uses and values of learning technology.

Chapter 4 addresses the second research question on principles for using technology with adult basic skills learners.

Chapter 5 focuses on the third and fourth research questions concerning the populations of interest.

Chapter 6 offers brief conclusions.

2. The evidence base and evidence gaps

In Chapter 2 we describe the evidence base and highlight where gaps are evident.

2.1 The evidence base

A total of 27 studies were included in this evidence review. These included 7 evidence reviews and 20 primary research studies. The 7 evidence reviews covered a range of topics from the broad – Carpentieri et al., (2010) on adult numeracy; Stites (2003) on new learning technologies; Askov et al. (2003) on access to online education; Lesgold & Welch-Ross (2012) on instruction – to the specific – Savill-Smith & Kent (2003) on palmtop computers; Tayebinik & Puteh (2012) on mobile learning; McDonald (2010) on ESOL.

Annex A2 provides an overview of the 20 primary research studies, with a description of each source, its methodology (research questions, population, data, sample) and findings.

The primary studies tended to adopt single (14) rather than mixed-method approaches (6), and can be almost evenly split into studies using quantitative (6) and qualitative (8) research designs primarily using interviews and observations. The research was predominantly from the United States (14 studies), with most others from the United Kingdom (8) and Australia (3).

Six of the 20 primary research studies focused on adult literacy learners, 3 on adult numeracy/mathematics learners, 7 on adult ESOL/ELT learners, and 4 on learners studying more than one basic skills subject. Four studies focused on adults with learning disabilities or learning difficulties. One study looked at female welfare recipients, and one at the prison population.

The 20 primary research studies focused on a range of learning technologies including computer assisted instruction (8), online learning (2), classroom interventions (3), and virtual learning (2).

2.2 Evidence gaps

The evidence base was small, suggesting that very little high quality research has been carried out in this area, either in the UK or internationally. This is not to say that there is little use of learning technology with adult basic skills learners; a review of practice would likely throw up a rich picture of practitioners and providers engaging with new technologies and incorporating them into learning programmes. However, evidence to support and inform these developments is lacking, meaning that there is a danger that existing initiatives may have less impact than expected and may even be counter-productive. The gaps identified below should inform the design of

research programmes in this area to ensure that the evidence compiled is robust, comparable, and of direct use to policy.

The evidence is extremely varied and often of limited applicability outside the immediate context in which it was gathered. There is insufficient hard empirical data to consolidate findings by type of technology; make comparisons between different types of technologies; or calculate effect sizes. The limitations of the evidence base can be classified under three headings: methodology, learners and delivery; and technology.

2.2.1 Methodology

- We identified no evidence from randomised controlled trials, the highest quality source of evidence. The primary sources include 8 studies (quantitative and mixed methods) which included tests to measure learning gains in the research design, but the sample sizes in most cases were very small. One study (Chen et al., 2011) drew on data from a large household survey, but the study's population was not representative of the wider population (volunteer).
- Most quantitative studies in the evidence base are very small in scale, meaning that statistically robust analysis cannot be conducted given the small sample sizes. As the samples are not representative, findings cannot be generalised to wider populations.
- Often the outcome measured related to a very specific skill, for example, vocabulary gains, or increases in fluency. Although these messages are useful to programme designers and teachers, this type of finding has very limited application in a study with our research aims, and limited application for policy makers.
- A number of research designs included no comparison group or control group; this means that any gains that may or may not be made during the ICT treatment were not compared to other forms of educational intervention. Learners in the sample (or remaining in the study) were often self-selecting. Where these learners were also more confident with ICT, they may not have been representative of many basic skills learners.
- A number of qualitative studies in the evidence base drew their data primarily from observations and interviews. Such studies can be illuminating and can be an important staging post in theoretical developments. However, self-report and subjective evidence have limited value in informing policy decisions.

2.2.2 Learners and delivery

- A number of studies looked at very specific cohorts of learners, such as adults with learning disabilities or learning difficulties. Even within these studies, the learner body was marked by diversity.
- Variation between the three learning areas within the scope of this review, literacy, numeracy and ESOL/ELT, makes it unrewarding to draw conclusions across the three – what works for numeracy may not for literacy and so on.
- The evidence base has very little to say about pure online learning or computer mediated learning that is not supported by face-to-face contact with a teacher.

Most evidence focused on forms of blended learning, in which learning technology was combined with traditional forms of learning.

2.2.3 Technology

- The evidence base was primarily concerned with the efficacy of computer-mediated instruction (not computers connected to the Internet) for learning in formal educational settings. Research on the effectiveness of using computers and the Internet in support of informal learning and for learning by adults is still in its infancy.
- Our understanding of the effectiveness of using computers and the Internet in support of informal learning and for learning by low-skilled adults relies instead on research concerning technology use in education from the school and university sectors.

The review of German-language sources and the review of French language sources faced similar problems in identifying the evidence base. As with the English-language base, this was sparse and mostly qualitative, with data drawn from reflection and observation and not from robust quantitative measures of success. Both reviews pointed to the lack of student voice in the evidence base and called for more data to be collected on adults' experiences of using learning technology to improve their literacy, numeracy and language skills.

Many of the sources in our evidence base included reviews of related literature[16]. These bore out the conclusion that very little research exists on the uses and value of using learning technology in adult basic skills delivery. We do know a lot about how adult learners learn, but not much about how adult learners learn with technology. And we know a lot about how technology is used in learning, but very little about how technology is used is adult basic skills learning.

[16] For example, Griffin (2008) found no studies involving cooperative learning and computer assisted instruction in a developmental mathematics classroom; Savill-Smith & Kent (2003) found no research on the use of handheld computers with young adults; Stites (2003) concluded that there is "*almost no research on the effectiveness of technology in adult literacy education*" (p. 312).

3. The value of learning technology to adult basic skills delivery

In chapter 3 we analyse the evidence base with reference to the first research question: What does the evidence base now tell us about the value of using technology-rich approaches in adult literacy, numeracy and ESOL/ELT delivery? It also examines the evidence for findings related to six research hypotheses focused on cost-effectiveness, flexibility, motivation, and engagement and retention.

3.1 Literacy

Six studies in the evidence base focused on the delivery of adult literacy. Three of these, all from the USA, examined Kurzweil 3000 text-to-speech software (McCulley 2012; Silver-Pacuilla, 2006; Engstrom 2005)[17]/[18].

Measurable learning gains

There was little evidence of any clear learning gains in literacy emerging from the use of ICT-rich approaches. Although McCulley (2012), for example, found statistically significant increases in literacy scores using Kurzweil 3000 software with offenders with low-literacy skills, there were limits in the research design (different intervention implementation in the two sites – a male prison and a female prison – no control group; high rates of attrition associated with the prison population) which mean that the findings were indicative only.

Mellar et al. (2007) compared results for seven different ICT interventions, but found statistically significant improvements in mean reading level for only two of the interventions (the e-Portfolio and m-learning schemes of work – see Appendix A2). No correlation was found between changes in ICT-skills and ICT-confidence scores and changes in reading and listening scores, suggesting to the authors that the two areas of skills were being learned independently, with gains in one not affecting gains in the other. Although the results of this study are of interest, no control group was included in the research design, so no data are available on improvements made in the absence of interventions.

The findings for students with learning disabilities were marginally more encouraging, but still limited. Johnson and Hegarty (2003, cited in Li & Edmonds, 2005), working with adult learners who had mild to moderate learning disabilities, found that students were more likely to concentrate, participate, and converse when using the internet. Silver-Pacuilla (2006) found that using Kurzweil 3000 software with of adults with learning disabilities "*can be enabling and empowering"* (p. 123)*,* but it is difficult to generalise from what was

[17] This software uses verbal and written forms of communication, with words highlighted on screen and read to the student who listens with headphones.
[18] The other studies of adult literacy were Barden (2011), Chen et al. (2011) and Synder et al. (2005).

essentially a very small study. Engstrom (2005) also found this software, and other assistive technology, to be beneficial to adults with learning disabilities by scaffolding language development; again, however, this research took the form of a very small case study of 8 learners.

3.2 Maths

Three primary studies in the evidence base focused on the delivery of adult numeracy; one of these sources was an evaluation of software.

Measurable learning gains

Two studies reported quantitative analysis of the impact of an ICT intervention on maths achievement scores. Li & Edmonds (2005) found the use of computer-assisted instruction (CAI) with "at-risk" adult learners appeared to be effective for basic mathematics (whole numbers, fractions, and decimals), with the treatment group scoring significantly higher than the control group. That gain was not evident in relation to more advanced skills (which required more sophisticated mathematical language), where there were no significant differences between the gains of the treatment and control groups. Nonetheless, tests demonstrated that learners in the treatment group were learning just as well as those in the control group: there were no negative academic impacts of using CAI.

The mode of working may be important; Griffin (2008) found that adult learners on a short developmental mathematics course who *worked collaboratively* with CAI significantly outperformed learners working alone with CAI. The indications here, though, were that the measured improvement in skills, punctuality and attendance may be related as much to social factors as to ICT factors, with those working collaboratively not wanting to let their partner down by not attending class. This may, in turn, have impacted on their improved mathematic achievement scores.

Increase in autonomous learning

There are indications that digital technologies may contribute to more autonomous learning, but the evidence base is small. Carpentieri et al.'s 2010 review of research on adult numeracy, for example, highlighted a qualitative evaluation (Harris, 2005) of a small-scale experimental course CyberLab, in which numeracy teaching was delivered to nine learners through activities involving cameras, the Internet, computer programming, numerical calculations and data tabulation (Harris, 2005 cited in Carpentieri). Researchers saw evidence of autonomous learning, as learners worked together through breaks and outside of class hours. Learners themselves reported developing transferable skills in planning, problem-solving and self-evaluation.

3.3 ESOL

Seven studies in the evidence base focused on the delivery of adult ESOL/ELT. Three of these (Tozcu and Coady, 2004; Blake, 2009; and Arslanyilmaz & Pedersen, 2013) reported studies of the impact of an ICT intervention on gains in language skills.

Measurable learning gains

The evidence base around the impact of ICT on learning in ESOL appears more robust, but is still subject to qualification.

While Tozcu & Coady (2004) found significantly greater gains in vocabulary knowledge, reading comprehension and frequent word recognition amongst students using Computer Assisted Language Learning (CALL) than amongst a control group learning conventionally, there was a high drop-out rate amongst the treatment group (thought to be due to dislike of the CALL). Moreover, although learning outcomes did not vary by gender, age or institution, reaction times amongst those whose native language was a Romance language appeared to improve faster than amongst native Asian speakers.

Blake (2009) found that ESL learners using synchronous computer-mediated communication (text-based Internet chat) scored significantly higher on two measures related to oral fluency than learners in either a traditional face-to-face or control environment (online activities but no interaction with peers)[19]. Even so, learners from the experimental group were sceptical that the course had improved their oral fluency[20].

Arslanyilmaz & Pedersen (2013) compared the progress of two small groups of young ESL students (aged 18-29) learning in an online Task-Based Language Learning (TBLL) environment, where one group had access to subtitled videos. Students who were able to familiarise themselves with the tasks through subtitled videos were more actively engaged in "negotiation of meaning", that is, the processes whereby students come to understand each other, than students with no access to videos. These findings were consistent with the TBLL evidence base (as summarised by Arslanyilmaz & Pedersen, 2003, p. 64), with studies reporting learner engagement, improved communication skills, increased confidence and vocabulary.

Engagement of learners

Classes of ESOL/ELT learners are often very diverse. Learners can come from a variety of linguistic and cultural backgrounds, start with different degrees of familiarity with the English language (some working at very low levels), and experience differing degrees of social exclusion. The findings from the three included studies (Lewandowski, 2010; Koehler 2011 and Webb, 2006) are not consistent, however, partly because of scale and partly because the studies investigated different technology uses.

The Lewandowski research, for example, focused on the use of digital voice recorders. This small-scale action research study found that Entry level 1 learners did not have sufficient language skills to enable them to self/peer correct, but that those at Entry level 2 found the technology useful and

[19] Scores were significantly higher on "phonation time ratio" and "mean length of run" measures; score gains on "speaking rate", "articulation rate" and "average length of pauses" were not significant.

[20] The same observation was made by Li & Edmonds (2005) where, despite the gains made, exit survey data showed that approximately half the students were still unsure of CAI as an instructional tool.

beneficial[21]. The Koehler study looked at using a multimedia instructional programme. This small scale, non-experimental study suggested that learning gains were higher for those who had the lowest language skills in pre-tests.

There are some indications that ICT has a role to play in reducing some aspects of social exclusion, by offering a space for language learning and practice that is not necessarily available in traditional ESOL classrooms and in the everyday lives of marginalised groups. Qualitative evidence gathered by Webb (2006) in a study of English language learning programme delivered in Learndirect centres suggested that technology is insufficient to overcome existing inequalities in access to learning, and to engage learners who would not otherwise undertake formal learning.

Both the German and French language evidence reviews highlighted the fact that the use of ICT and the internet in could benefit from a greater understanding of how migrants make use of ICT facilities (such as cybercafés – Scopsi,2004) and social networks (Diminescu, 2005, 2008, 2010) to remain connected to their friends and families.

3.4 Cost effectiveness

***Hypothesis 1**: Technology-rich delivery of adult English OR adult maths OR adult ESOL/ELT learning is more cost-effective for all or some types of learners than learning where the primary interface is face-to-face with a teacher or facilitator.*

None of the research included in the learning technology evidence base reported on the cost-effectiveness of the adult basic skills programmes described, either in and of themselves, or in comparison to traditional face-to-face teaching methods.

This finding is consistent with a review of research and evaluation on improving adult literacy and numeracy skills by SQW/NRDC for BIS (Vorhaus et al, 2011) which found little evidence on the cost-effectiveness of ALN programmes, either as a whole, or of specific delivery models and methods. Vorhaus et al recommended that future Department research centre on a series of cost-benefit/cost-effectiveness analyses for different modes and methods of delivery that are known (or believed) to be effective (p. 82).

Although, Synder et al. (2005), Koehler et al. (2011), and Savill-Smith and Kent (2003) all commented on the need for investment in reliable, quality technology (including multi-media, electronic books and palmtops), none provided clear cost data. This was also the case with the German language evidence review, which drew attention to the advantages of mobile learning technology, but could not identify any assessment of cost-effectiveness.

[21] A similar point was made by a source cited in the German-language literature review: disadvantaged learners can face difficulties with e-learning, not because the technology itself is problematic, but because they struggle to gain and apply study skills (Grotlüschen, 2006).

3.5 Flexibility

Hypothesis 2: *Technology-rich delivery improves learning outcomes when compared to traditional forms of delivery by increasing retention in learning through offering flexibility to learn at more convenient times for the learner and/or extend the amount of time learners are learning.*

Two studies (Berger, 2005 and Savill-Smith & Kent, 2003) discussed the opportunities offered by learning technology for flexible learning. However, none of the research included in the evidence base focused specifically on outcomes related to learner retention. None of the studies referred to the extension of learning hours through learning technology.

No high-quality evidence was available on which the impact of flexible/extended learning on learner retention could be assessed.

3.6 Motivation to learn

Hypothesis 3: *Technology-rich delivery improves learning outcomes when compared to traditional forms of delivery by increasing students' motivation to learn.*

There was evidence of teachers' and providers' belief in the impact of learning technology on the motivation of learners, but no evidence that suggested it improves learning outcomes as a result. Increased potential for interactive teaching and learning was cited as the key to increased motivation.

In a study by Mellar et al. (2001) of literacy and numeracy classes that incorporated ICT, 92% of learners (mainly males) said that they found the use of ICT motivating. In interviews, 64% of learners said that ICT helped them to learn; many also said that it helped them to concentrate. Many learners felt that they had improved their ICT skills, though this had not been one of their initial goals. A further 26% indicated that their employment aspirations had changed, and that they now wanted to use ICT more at work.

Berger (2005), Coben et al. (2007), Kambouri et al (2003)[22], and Mellar et al. (2007), all cited evidence of the motivational role of ICT materials. Nonetheless, their research suggests that it is the level of interactivity of the materials and tools (where these encourage collaboration) rather than the use of ICT per se that may be more important. In a study of ICT classes, Mellar (2007) noted that the need to share resources (where collaboration was imposed rather than emergent) was counterproductive and that, "classes where individual learners spent more time working on their own showed better gains in ICT skills than those classes where more time was spent working in small groups" (p. 8).

[22] Coben et al. (2010) and Kambouri et al. (2003) are discussed in Carpentieri et al. (2010).

Hypothesis 4: *Technology-rich delivery improves learning outcomes when compared to traditional forms of delivery by increasing students' motivation to learn, even where their participation is mandated.*

None of the research included in the evidence base reported on learning programmes where participation was mandated and we were therefore unable to assess the impact of technology-rich delivery on mandated provision.

3.7 Feedback and reinforcement

Hypothesis 5: *Technology-rich delivery improves engagement, particularly for young adults, because it provides immediate feedback and re-enforcement.*

Hypothesis 6: *Technology-rich delivery improves retention, particularly for young adults, because it provides immediate feedback and re-enforcement.*

One study reported qualitative findings (observational research) on the relationship between immediate feedback and learner engagement. Another source in the evidence base examined the relative merits of computer- and paper-based assessment of literacy tasks (but not immediate feedback) by learner characteristics.

There is no hard evidence that would enable us to assess the impact of immediate feedback and re-enforcement on learner engagement and retention. One source suggests that immediate feedback may be a particular motivation to numeracy learners; another that some basic literacy learners may be penalised by computerised forms of assessment.

Chen et al.'s (2011) study comparing computer and paper-based administration of writing assessments found that all respondents performed better on paper than with computers, with black participants and unemployed participants more negatively affected than others when using computers. The authors speculated that the differences in performance may be explained by different cognitive processing demands required by the different modes, and that this may be evidence that writing on a computer is more demanding in terms of cognitive processing. The authors argued from their findings that:

> "Requiring all examinees to write on computer could significantly underestimate the written communication skills of the disadvantaged adults. Therefore, an adult writing assessment should provide examinees with a choice of composition medium if the purpose is to measure how well adults write, no matter in which medium" (p. 68).

Mellar et al., 2004 (as cited in Carpentieri et al, 2010) identified key factors associated with the effective use of ICT in the teaching of ALLN. The software gave learners on a Level 1 numeracy course immediate feedback on their performance, allowing them to see what they had got wrong and to repeat exercises if they wished. Learners generally saw this feedback as useful, particularly when practising tasks in which they already had a good understanding, enabling them to concentrate on weaknesses and work at their

own pace. However, computer feedback was seen as less useful when learners were working on tasks they did not understand as well. In this situation, learners needed more (and more complex) feedback than a computer could provide.

4. Principles informing the choice and use of technology

In Chapter 4 we analyse the sources in the evidence base with reference to the second research question: What principles should inform the choice of and use of technology in adult skills delivery?

Given the heterogeneity of the evidence base, and of the adult learner body, the scope for drawing general principles for the educational use of ICT with basic skills learners is limited. However, it is possible to identify from the evidence a number of relevant questions concerning the choice of **technology** and its **implementation** as part of a learning programme. These questions provide a framework for the analysis of learning technology interventions with this particular group of learners. Such a framework will be of use in understanding and comparing interventions using different technologies and implementation processes. We can group these factors under two headings: technology and implementation.

4.1 Technology

4.1.1 To what extent is the chosen technology sensitive to the different ICT skills of learners, and to the differences in experiences and attitudes between younger and older learners?

Adults have differing expectations of ICT and may lack in confidence when using technology. There may be differences between the ICT skills and attitudes to technology of younger and older adult learners, and particular care may need to be taken to develop the skills of older learners. The use of a wide range of up-to-date digital technologies might be motivational for adults (Mellar et al, 2007).

Findings from McCulley (2012) suggest that future studies should collect information on how user-friendly participants found the technology.

4.1.2 To what extent does the chosen technology enable learning to be tailored to the needs of the individual?

Lesgold & Welch-Ross (2012) noted that computer environments have promise because of the complexity of assessing and teaching to the needs of individual learners. Adult basic skills classes are characterised by variety of different (individual) learning needs, suggesting that learning technology can play an important role.

> *"Digital media are a promising way to give access to a broad range of text genres and topics to stimulate interest in reading and writing for all students, including adults. The use of digital technologies—to expose learners to genres and topics, to scaffold their learning with prompts and other supports, and to help them practise—is likely to motivate their interest in at least three ways: technologies are novel, they can ease the unpleasant parts of practice, and they can empower the learner through*

> *development of valued, relevant digital literacy skills." (Lesgold &* Welch-Ross *p. 21)*

Berger (2005) suggested that the introduction of technology may lead to a change in the role of the instructor from lecturer (teacher holds all the knowledge) to facilitator, allowing instruction to be tailored to the needs of individuals.

4.1.3 To what extent is the chosen technology blended with traditional forms of instruction?

Li & Edmonds (2005) found that students' knowledge, skill, and ability reflected in face-to-face settings were easily transferable to online environments. There was evidence of reciprocal transferring of skills and knowledge between in-class and online learning. Both mediums helped strengthen student learning, which was evident in their work, understanding, and ability both in class and online. This suggests that the continuity of online and in-class learning helps bridge possible gaps in understanding.

As the German language review emphasises, the successful implementation of learning technology with adult basic skills learners is linked to other skills these learners need to gain, for example in becoming autonomous learners. Blended learning, by incorporating periods of online learning and periods of traditional learning, offers adults face-to-face support of a teacher in gaining these skills, but also periods of learning independently.

4.1.4 To what extent does the chosen technology allow for, or facilitate, learning situated in real world practices?

Taylor (2006, cited in Thomas, 2009) suggested that skills acquisition and maintenance is most effective when learning is linked to learners' everyday practices

> *"Informal learning also takes place as with any activity that involves the pursuit of understanding, knowledge, or skill development. This occurs with such activities as increased reading and writing skills through computer research, writing e-mail, or improving math skills while comparison shopping. "* (p. 217)

Thomas emphasises this:

> *"... given the busy schedule and the multiple demands that low-income families experience, continuing literacy education could be best strengthened by providing a mechanism by which participants could engage in their own learning at a time that was suitable to them and to learn at their own pace at home."* (p. 218)

For example, on one course investigated by Coben, et al, (2007, cited in Carpentieri, 2010), learners were instructed to take pictures of maths in the real world. Car parking charge signs, angles of buildings and other shapes were posted on a classroom board. These photographs were then used to instigate classroom discussion about mathematical concepts.

4.1.5 To what extent does the chosen technology effectively scaffold learning?

A number of studies highlighted the potential role of technology in scaffolding learning, supporting learners to achieve their learning goals by providing access to extra guidance and / or information. With CAI, learners can work through examples and interactive exercises while receiving individualised hints and immediate feedback. Content can be accessed for as long and as often as learners want.

A small pilot study by Engstrom (2005) reported on literacy learners with learning disabilities and attentional disorders on a course where a number of assistive technologies (including Kurzweil 3000 and Inspiration, software which aids mapping or outlining key elements of text) were integrated with traditional instruction on active reading. Engstrom concludes from her (very limited) evidence of positive outcomes for the students involved that for learners with literacy needs:

> *"the importance of combining reading and writing strategy instruction with assistive technology support and word-level instruction in a way that scaffolds the students' total written language development." (p. 36)*

Engstrom speculates that the variety of text structures offered by the program of integrated learning is a way of scaffolding the learning experience:

> *"… so that students gain a deeper understanding of the conceptual base of written language. By supporting text structure instruction with a text reader and the software to visually represent the concepts and patterns in the text, we expand the ways in which students can understand and process text. By giving students of diverse learning profiles the opportunity to learn word structure through exposure to sounds, syllable patterns, and word analysis, we give them the tools to automatize their word recognition and to free them to focus on understanding written language."* (p. 39)

4.1.6 To what extent does the chosen technology encourage collaboration between students?

A number of studies highlighted the effectiveness of collaborative learning on the learning gains made in adult basic skills, and the role of technology in fostering collaboration between learners and supporting a constructivist approach to learning.

There are some references in the literature to Virtual Learning Environments (VLE) encouraging collaboration between tutors and students, and particularly between peers. Maguire et al's (2006) evaluation of VLE software has very limited relevance to this review as its primary focus was on how the VLE would help adults at pre-entry and entry levels who had severe learning and communication disabilities. However, it did record positive results in the use of the VLE. Pleasance (2010) found that Moodle, a popular web application that is used to create VLEs for individual courses, increased learner motivation and engagement and provided opportunities for real communicative tasks, such as

online discussions, social networking with other learners or communicating with the teacher about coursework.

4.2 Implementation

As well as understanding the technology used we also need to know how the learning programme was implemented. Much of the relevant information is recorded on standard quality assurance documents produced as part of internal provider processes. However, three factors are mentioned consistently in the literature that should also be considered when assessing such an intervention.

4.2.1 What is the role of the teacher?

The role played by the teacher in the learning intervention is varied and demands attention. Somekh, 2007 (cited in Barden 2011) suggested that simple transmission models, in which the teacher imparts knowledge and the learner absorbs it, may no longer be appropriate. Instead teacher and student roles may have to be more fluid and dynamic, as teachers can no longer control the wealth of information that enters the classroom. In addition, teachers and learners are likely to bring different, but potentially complementary technology skill-sets into the classroom.

Snyder et al (2005) concluded that teachers are more important as facilitators when learning technology is deployed. They noted that effective teaching and learning, even in technology-mediated settings, most often involves interactions among humans. Li & Edmonds (2005) stressed that their findings demonstrated that it was vital that teachers are available any time students need their support. Thomas (2009) stressed the importance of engaging and keeping weekly face-to-face contact with the literacy instructors and employment advisors.

4.2.2 Do teachers have the skills and knowledge that they need?

Synder et al. (2005) stressed that to facilitate the effective integration of the use of information and communication technologies in adult literacy education, teachers and others involved in design and delivery of such learning interventions require professional development activities that focus on technology-mediated learning. Teaching using technology requires sophisticated technical expertise and technical support, demanding educators with good technical skills, with access to quality, reliable equipment, and to technical support.

Research from Germany also emphasised the need for teacher training to keep pace with technological change, both in terms of ensuring that teachers themselves have the ICT skills to use the technology, and that they engage in CPD that acknowledges the change that the use of technology brings to the teacher's role. The French language review noted that in formal learning, ICT has been imposed by reforms that are not always accompanied by teacher training, which has generated tensions (Pelgrum et al, 2004: 71).

4.2.3 How effective is induction in preparing students for learning?

How effectively induction is organised and delivered appears to be a significant factor. Providing learners with clear and timely information is particularly important in directing the learners' attention to what they are expected to learn from the use of the technology and how they are expected to do this. Webb (2006) noted that induction could also encourage the use of all the features of the software.

5. Populations of interest

Chapter 5 analyses the evidence base and publically available statistical data with reference to the third and fourth research questions: How does current engagement with technology vary between different populations of interest? How large are the following possible groups of interest at present: Apprentices, other employed learners, those claiming Job Seekers Allowance? It also briefly addresses two research hypotheses related to learners' existing ICT skills

5.1 Engagement of different populations of interest

5.1.1 Unemployed learners

One US study (Thomas, 2009) considered the engagement in online learning of unemployed women enrolled on a literacy programme. While there were some apparent positive outcomes (participants indicated that having computers in their homes increased their autonomy and interest in learning and helped them overcome their fear of computers), the evaluation evidence was very limited in scope, self-report data were inconsistent and incomplete and no comparisons were made with employed learners.

5.1.2 Older and younger age groups

A number of studies tested the hypothesis that different levels of engagement with technology will be experienced by learners of different ages, with age associated with level of ICT skills or extent of familiarity with digital technologies. Here the message was clear: different strategies will be required to engage these different populations, and engaging older learners is likely to prove the greater challenge.

Studies by Snyder et al. (2005) and Kambouri et al. (2003, as reported in Carpentieri et al., 2010) found evidence that older learners were at a disadvantage when using new technologies. Kambouri et al.'s evaluation of Max Trax, an educational computer game to improve numeracy skills, reported that individuals aged over 30 who had limited or no experience playing computer games suffered a steeper learning curve. Snyder et al. (2005) reported case study evidence on the distinctions in ICT use between older (40+) and younger learners:

> *"Individuals who had embraced computing at an older age were able to improve the quality and connectedness of their lifestyle […] However, there remained a considerable age disparity in relation to the use of the technologies. The rapidity of the introduction of new modes of digitally mediated communication into the market place brings in its wake raised barriers to access information and to associated social and employment opportunities."* (p. 38)

Synder et al. concluded that for these older learners, many of whom were unemployed and faced multiple disadvantages, *"Low-cost access, facilitated by introductory programs, and well-maintained hardware and software" were likely to be needed to "prevent entrenching or even extending existing disadvantages"* (p. 38). For younger learners (especially males), the study identified a need to enhance the quality and range of opportunities to acquire integrated literacy/technical skills.

Studies by Attewell and Savill-Smith (2004b, cited in Carpentieri et al, 2010) and from Germany (Cramm & Neudorf, 2010) found that young adults were highly motivated to learn using phone-based games and game-based training. Attewell and Savill-Smith, for example, reported that over three quarters (78%) of survey respondents felt that mobile learning games could help them improve their maths[23]. Barden (2011) emphasised that using digital technology is normal to the generation (known as "Digital Natives") currently in and emerging from formal education:

> *"Teenagers now are not now characterised merely as users of digital technologies: they are seen to be immersed in digital technologies, living 'always on', 'hybrid lives' which combine the physical and the virtual in creating complex 'tapestries' of communication and connectivity (Hulme, 2009 p.4). Hulme (2009) found that 95% of 16-24 year olds self-reported often using a number of technologies at the same time. 75% said they 'couldn't live without' the internet. As such, it is difficult and perhaps even negligent for educators to ignore the appeal to this group of learners of audio-visual, multimodal technologies. We need to also take account of their habitual simultaneous use of multiple forms of ICT." (pp. 15-16)*[24]

McCulley's (2012) evidence review made a similar point; however, in concluding that "*younger adult students have grown up in a digital environment, they may actually think differently than older people who did not grow up in the digital environment*" (p. 9) McCulley cautioned against making universal assumptions:

> *"not all students in adult education classrooms were trained within this new, digitally enhanced paradigm. Some students see 'doing school' much the same today as in their earlier formal educational experiences, no matter how long ago they took place. For them, the use of technology may be perceived as 'fluff' unnecessary for educational attainment."* (p. 9)

5.2 Existing computer skills

Hypothesis 7: *Technology-rich delivery varies in effectiveness for different learners depending on their pre-existing familiarity with the technologies involved.*

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[23] 128 learners in the UK, Italy and Sweden, 80% of whom were unemployed, took part in this multinational research project looking at the potential of mobile phones as learning devices for young adults (aged 16–24).

[24] Hulme, M. (2009) *Life Support. Young people's needs in the digital age.* London. YouthNet. Available online: http://www.youthnet.org/wp-content/uploads/2011/05/Life-Support-Report.pdf (accessed 22/05/14). Statistics are from a survey of 994 respondents between the ages of 16 and 24 commissioned by YouthNet and undertaken by The Futures Company.

Three studies analysed the relationship between existing ICT skills/confidence and intervention effectiveness. This evidence is inconclusive. One very small quantitative evaluation of a multimedia instructional programme for ESL learners (Koehler et al., 2011) found no relationship between level of computer skills and performance in grammar tests.

Other studies offered lower quality evidence that existing skills were a factor. Mellar et al. (2007) found that learners with higher initial ICT-confidence scores were more likely to persist on the courses (traditional learning blended with one of seven IT components, see Annex A2). Those with lower scores were likely to attend less frequently, and were more likely to eventually drop out. A qualitative evaluation of an ICT-based CD-ROM learning package (Webb, 2006) found that previous IT experiences contributed to successful learning for ESOL learners.

Hypothesis 8: *The cost-effectiveness of technology-rich learning varies depending on the type of delivery (adult English, maths or ESOL/ELT) independently of pre-existing familiarity with technology.*

No research in the evidence base reported on the cost-effectiveness of technology-rich provision. Recently, however, the Tinder Foundation (2014)[25] costed the investment required to upskill 100% of the UK adult population with the Basic Online Skills they need to regularly use the internet for themselves by 2020. The investment required was calculated as £875 million; or £292 million each from the government, the private sector, and the voluntary and community sector[26]. There is only very limited potential to read lessons from this report across to adult basic skills delivery, but it highlighted that the population lacking basic online skills[27] is also likely include people who have literacy and numeracy needs and who have higher rates of unemployment, disadvantages which would make the need for costlier bespoke and targeted services more likely.

5.3 Data review

In seeking to establish the size of the populations of interest (those adults either in work, or learning, or seeking work, and for whom the use of technology might provide a cost-effective way of enhancing their basic literacy or numeracy skills), it is important to note that most publicly available data is collected and distributed for a particular purpose (see Annex B4). Thus, while information collated on claimants for Job Seekers Allowance may provide monthly information on the number (and type) of claimants and on the funds disbursed, the data is collected primarily for administrative and accountability purposes rather than to provide insights into the detailed demographic profile of claimants. Information collected through the BIS

[25] The Tinder Foundation provides a learning platform called Learn My Way. Since 2010, over 1.2 million new people have got online in the UK using Learn My Way, with many of them progressing on to employment or further learning.
[26] Based on an estimated 6.2 million adults in the UK without basic online skills in 2020 and a model where the upskilling costs ranged from £47 to £319 per person.
[27] The GO ON definition of Basic Online Skills includes knowing how to: send and receive email; use a search engine; fill out an online application form; identify and delete spam; evaluate which websites to trust; set privacy settings.

Skills for Life survey provides estimates of the mean proportion of adults (16-64) by basic skill level, but does not present those skill levels related directly to other demographic characteristics, such as participation in training or employment. Quarterly data on learner participation, outcomes and level of highest qualifications collected by the Skills Funding Agency and BIS provides insights into the progression of learners on basic skills courses, but while published participation data is broken down by learner age bands (19-24, 25-49, 50+), data on attainment is presented as a single age band (age 19+ only).

The 2011 Census, which provides the most comprehensive source of data (collating information on age, gender, domicile, qualifications and occupations for all people domiciled in England down to the lowest level of spatial detail – the lower super output areas or LSOA[28]) gives more demographic insights. Data has been published on the size of the unemployed adult population with basic skills, for instance, as well as on the sub-cohort of lone parents with low qualifications, but there are no plans at present to publish data on, for example, the level of qualifications amongst young (19-24), unemployed, male single parents. Furthermore, there is no published data on the skill levels of the prison population. From a policy perspective, therefore, identifying the potential scale of the populations of interest is currently problematic.

In the data review, we explored 40 datasets from nine different sources. Of these, four sources (the Census, the DWP data on Job Seekers Allowance, data form the SFA and BIS on Adult FE & Skills, Apprenticeships and Workplace Learning and the BIS Skills for Life Survey) proved the most fruitful. In Table 5-1, we summarise the various data breakdowns that are currently in the public domain, data that is available *in part* (requiring further cross-tabulations), data that *could be made available* (were additional analyses undertaken with the data that is collected) and data that is *not currently collected or collated*. At present, the available and published data indicates that, in 2012/2013:

- **1.1 million adults** (aged 19 and over) participated in government-funded further education (excluding in schools and higher education) in basic skills English and Maths. This suggests that there is a potentially large population who might benefit from technology-rich courses, but we do not know anything about the level of ICT skills amongst this cohort, in order to make any further assessment of the likely appeal or success of such an approach
- **868,700 people** aged 16+ participated in Apprenticeships. Just over half (55%) were aged between 16 and 24. Published data includes Apprenticeships starts by age (under 16, 17, 18, 19-24, 25-34, 35-44, 45-59, 60+) and by gender (but not by age and gender); by age and level and by gender and Apprenticeship level (but not by age, gender and Apprenticeship level). This means that providing an indication of the number of female Apprentices aged 19+ who would benefit from technology-rich basic skills

[28] In 2011, there were a total of 32,844 LSOAs in England. An LSOA is defined by the size of its population and the number of households it contains. The minimum and maximum population size is 1,000 and 3,000 respectively, while the number of households ranges from 400 to 1,200. The LSOAs are used as the standard unit for reporting small area statistics and boundaries can change when the population or household thresholds are breached.

course in literacy and numeracy cannot currently be estimated. The data that is collected about Apprenticeships, however, means that it may be possible to calculate this in the future

- **30,900 learners** started workplace learning at below Level 2. From the current published data, we do not know either the age nor the gender of these workplace learners
- 70% (**3.2million**) of the lone parents in England aged 16+ had qualifications at Level 2 or below (based on 2011 Census data). Although the data has been collected, existing analyses do not enable us to estimate the proportion of these low skilled lone parents who are male or female
- 89% of the **120,510** JSA lone parent claimants at February 2014 were female and 88% were aged 25-49. The currently published data does not allow us to estimate the proportion of such claimants who were both female and aged 25-49 and we do not know anything about their skill levels.

As indicated in Table 5-1, were additional data cuts undertaken, it would be possible to estimate the size of the population more closely. In particular, we suggest that data cuts could be made of:

- the **Census 2011**: to provide national and LSOA-level data on lone parents by level of qualification, age, gender and economic activity
- **DWP Lone Parent JSA Claimant Data**: if the age information (currently collected as chronological age) was divided into smaller age bands and cross tabulated by gender, we could estimate the size of the various gender and age groups claiming JSA, but we would still have no information on skill levels.
- **SfA and BIS - Adult FE & Skills, Apprenticeships and Workplace Learning**: data on age and on skill levels is collected at a more detailed level than that provided in the currently published cross-tabulations. It would be useful to be able to explore this more detailed data and also assess whether attainment data could be broken down in a similar fashion.

Table 5-1: Summary of datasets and data availability

Available / Partially available / Potentially available / Not available	Census 2011	BIS Apprentice ships	BIS Adult FE & Skills	BIS Workplace Learning	SfL Survey	DWP JSA Claimant Count
GENERAL ADULT POPULATION (16-65)						
AGE						
+ gender						
+ skills level (L2 & below)						
+ employment						N/A
SKILLS LEVEL (L2 & below)						
+ age						
+ gender						
+ employment						N/A
+ subject		N/A				
PARTICIPATION IN TRAINING						
+ achievement						
+ age						
+ gender						
+ subject		N/A				
+ skills level (L2 & below)						
KEY GROUPS						
JSA						
+ age						
+ gender						
+ skills level (L2 & below)						
LONE PARENTS						
+ age						
+ gender						
+ skills level (L2 & below)						
PRISON POPULATION						
+ age						
+ gender						
+ skills level (L2 & below)						

6. Conclusions

We can conclude that the evidence base has changed little since Torgerson et al. (2004). At present, the results of the study of the use and value of technology with adult basic skills learners can best be described as a conversation rather than an evidence base. What evidence there is, is localised, and often focused on very specific groups of learners with specific concerns or circumstances.

In the course of conducting this review, a number of strategies for widening the search were suggested and, after close consideration, rejected. It was concluded that lessons from compulsory or higher education, from the teaching of English as a Foreign Language, and from basic digital skills were not appropriate for the adult basic skills learner body. It is difficult to apply lessons from other contexts due to the diversity of contexts and supporting infrastructures in which adult basic skills learning takes place and to the diversity of the adult learner body, the specific needs of adults with poor basic skills and their different starting points/educational backgrounds.

Indeed, the review provides a familiar picture of basic skills learners; multiple, compounded disadvantages such as poverty, unemployment, problems with mental and physical health all need to be taken into account when designing learning interventions and setting the expected outcomes of these. Lesgold & Welch-Ross (2012) remind us of the importance of conducting research that explicitly targets particular groups of adults as well as being aware of the specific types of technology and the instructional strategies employed.

We need to understand more about how learning technology is currently used with adult literacy, language and numeracy learners before taking steps to ensure that research is undertaken to inform the implementation of a strategy for the employment of learning technology to support adult literacy, language and numeracy learning. The review of German language sources identified a need for further research concerning the impact of technology on learner progress, and this is something we support here. The lack of high-quality evidence prevents us from drawing any firm conclusion as to whether increased use of learning technology with adult literacy, language and numeracy learners leads to improved outcomes for these learners.

A scoping exercise is needed to find out, in the UK at least, whether this is because ICT is being used and is under-researched (perhaps because changes in technology are so rapid that research to assess its impact takes too long), or whether it is because traditional forms of teaching are still dominant. The framework for analysis of learning technology interventions should be used in such research to allow for principled comparison between interventions using different technologies and implementation processes.

Appendices

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