Good Practice in Integrated and Standalone Numeracy Provision at Levels 1-3

Background Report, Guidelines and Recommendations

2021

SOLAS learning works

etbi Education and Training Boards Ireland Boird Oideachais agus Oiliúna Éireann

NALA National Adult Literacy Agency Áisíneacht Náisiúnta Litearthachta do Aosaigh

Rialtas na hÉireann Government of Ireland

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List of Acronyms

Acronym	Full title
AEO	Adult Education Officer
ALL	Adult Literacy and Life Skills Survey
ALO	Adult Literacy Organiser
BTEI	Back to Education Initiative
CPD	Continuing Professional Development
CSO	Central Statistics Office
DEETYA	Department of Employment, Education, Training and Youth Affairs
DE	Department of Education
DES	Department of Education and Skills* [1]
DFHERIS	Department of Further and Higher Education, Research, Innovation and Science
ESOL	English for Speakers of Other Languages
ETB	Education and Training Board
ETBI	Education and Training Boards Ireland
FET	Further Education and Training
HSCL	Home School Community Liaison
IALS	International Adult Literacy Survey
ICT	Information and Communications Technologies
MABS	Money Advice and Budgeting Service
NALA	National Adult Literacy Agency
NRDC	National Research and Development Centre
OECD	Organisation for Economic Co-operation and Development
PIAAC	Programme for the International Assessment of Adult Competencies
PISA	Programme for International Student Assessment
PLC	Post Leaving Certificate
PLSS	Programme Learner Support System
QQI	Quality and Qualifications Ireland
SAG	Support to Apprentices Group
SOLAS	An tSeirbhis Oideachais Leanunaigh agus Scileanna/The Further Education and Training Authority
UNESCO	United Nations Educational, Scientific and Cultural Organization
VTOS	Vocational Training Opportunities Scheme

1 Please note: the Department referred to as The Department of Education and Skills is the Government Department that had responsibility for Further Education and Training at time of writing of this report. Responsibility for Further Education and Training now rests with the Department of Further and Higher Education, Research, Innovation and Science. The Department of Education and Skills has since been renamed the Department of Education.

Acknowledgements

NALA, SOLAS and ETBI would like to acknowledge the immense work, collaboration and cooperation that went into all elements of this study and the production of this report on the Development of Good Practice in Integrated and Standalone Numeracy Provision at Levels 1-3.

NALA was commissioned to produce these guidelines and recommendations on numeracy on behalf of SOLAS and ETBI and engaged the expertise of Merrilyn Goos, Niamh O'Meara and Kathy O'Sullivan at University of Limerick and Mark Prendergast at University College Cork as partners in delivering the resulting reports.[1]

We are grateful to the Chief Executives, Directors of Further Education and Training, Adult Education Organisers, Adult Literacy Organisers, Tutors, Resource Workers, Coordinators and all other staff in ETBs for facilitating and/or taking part in the research process.

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1 O' Sullivan moved from the University of Limerick to National University of Ireland Galway during this study.

Foreword

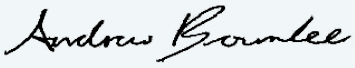
It is with great pleasure we present this significant research on integrated and standalone Numeracy in ETBs. This critical exploration, carried out for SOLAS and ETBI by NALA and their research partners at University College Cork and University of Limerick, adds to a significant body of research on literacy and numeracy emerging from the Further Education and Training sector in recent years.

The report, guidelines and recommendations are a testimony to the ongoing commitment to adult numeracy education in Further Education and Training (FET). The work was commissioned in response to the Literacy and Numeracy Strategy 2014-2019, which called for greater prioritisation of numeracy, and an increase in the amount of numeracy provision offered in integrated and standalone options. The many innovative approaches already in place or in planning at the local level have been thoughtfully presented, and observations made throughout are naturally reflective of numeracy practices observed during this time, and their attendant opportunities and challenges.

The research reveals an already solid instructional base for numeracy across ETBs, supported by the unwavering commitment and skills of all involved in the delivery of adult numeracy programmes. Also evident is the importance of helping learners to recognise and build upon their abilities and achieve their own unique learning ambitions. SOLAS, ETBI and ETBs will continue to work together to ensure that the good practice evident in this research is safeguarded, and the best possible numeracy provision and support is available to meet the many and varied needs of learners. To this end, SOLAS, in collaboration with ETBI, have produced a complementary suite of guidelines and toolkits aimed at enhancing the initial and ongoing assessment of literacy and numeracy at levels 1-3 and levels 4-6 which together will enhance learner access, participation, completion and achievement in FET.

It is hoped that focussing on a heretofore under-researched and under-theorised aspect of FET will encourage the continued exploration of numeracy over the course of the current Further Education and Training Strategy 2020-2024, where inclusion, skills and pathways for learners are emphasised. Equally, a commitment to implementing consistent support for learners and a framework for universal design for learning in FET will ensure that the recommendations from this research are addressed in a manner that is of greatest benefit to the learner and the sector more broadly.

We trust that this report on numeracy provision and the accompanying good practice guidelines and recommendations will provide a useful guide for ETBs, as they continue to support learners to develop their skills and confidence in numeracy and lifelong learning.



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Executive Summary

The OECD's (2013a) most recent international survey of adult skills found that around one-quarter of Irish adults scored at or below Level 1 on a six-level numeracy scale. At Level 1 on the numeracy scale, adults struggle to carry out basic arithmetic operations and procedures needed to function in everyday life. These results need to be interpreted in light of the devastating consequences that unmet adult numeracy needs have for individuals, communities and the economy. People at the lowest numeracy levels earn less income, have poorer physical and mental health and are more likely to be unemployed. Low numeracy levels amongst adults can also contribute to intergenerational cycles of inequality and disadvantage in families. Provision of adult numeracy support is therefore a priority for addressing economic and social disadvantage.

The aim of this research was to capture and document standalone and integrated adult numeracy activity in the Education and Training Board (ETB) context, in order to develop good practice guidelines and inform future development of adult numeracy policy and practice.

From April to November 2019 the study mapped the provision of adult numeracy across the 16 ETBs that deliver adult further education and training (FET) in Ireland. As a result, the study provides FET stakeholders (ETBI, SOLAS, Department of Further and Higher Education, Research, Innovation and Science, NALA) with a contemporary picture of adult numeracy activity in ETBs in Ireland against the backdrop of the FET strategy and wider related government policy.

In this study we understand adult numeracy to be both a technical skill and a social practice (Coben & Alkema, 2018). On the one hand, numeracy is a technical skill that enables people to access employment and participate fully in society. This perspective on numeracy foregrounds its value for a nation's economic development and global competitiveness. On the other hand, numeracy can be conceptualised as a social practice "embedded in people's lives as they interact with the social world at home, work, school or in the community" (Oughton, 2018, p. 6). Both perspectives are important for informing adult numeracy policy and practice.

Policy, Practice and Research on Adult Numeracy

The Further Education and Training (FET) sector in Ireland places a strong emphasis on improving the skills of adults, including adults' numeracy skills (SOLAS, 2014; National Adult Literacy Agency [NALA], 2017). Integrating literacy and numeracy into all FET programmes is a key element of the FET adult literacy and numeracy strategy. NALA has also developed guidelines for integrating literacy and numeracy with vocational and other further education and training courses (NALA, 2013b).

Internationally, there is consensus in the research literature that numeracy involves more than simple arithmetic skills, and that it cannot be defined solely by reference to the content of mathematics learned at school. Instead, numeracy is a multi-dimensional concept involving the use of mathematical knowledge, tools and dispositions in a variety of real-life contexts (e.g., Liljedahl, 2015). The affective domain is particularly significant for adult numeracy learners, who may suffer from feelings of anxiety and lack of confidence stemming from negative experiences of formal education.

The OECD's Programme for the International Assessment of Adult Competencies (PIAAC) defines adult numeracy as "the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life" (PIAAC Expert Numeracy Group, 2009, p. 21). However, a recent review of the PIAAC assessment framework has recommended elaborating on the definition of adult numeracy to incorporate additional competencies, such as dispositions to use mathematics, the ability to "see" mathematics in a numeracy situation, critical reflection on methods used and results obtained, consideration of the degree of accuracy required in real-life calculations, and use of digital technologies (Tout et al., 2017). These developments show that the concept of adult numeracy continues to evolve with the changing mathematical demands of 21st-century life and work.

Research Design and Methodology

The research design had three components. The first component involved **desk research** to establish the historical policy and practice context of adult numeracy provision in Ireland, and to conduct a literature review of adult numeracy research in Ireland and internationally.

The second component was a **survey,** which was distributed to each of the 16 ETBs, to establish the range and depth of adult numeracy activity in each ETB area. The surveys were completed by a designated officer in each ETB. Each ETB selected the person best positioned to access the information needed to

complete the survey on behalf of their ETB as their designated officer. Survey items addressed operational approaches, including access and progression; inter-agency partnerships; duration of programmes; resources; professional development of staff; evaluation; and outcomes. Survey responses were analysed and organised using descriptive statistics.

The survey was supplemented by site visits to each ETB for **interviews** and **focus groups** that captured the main approaches to, and operating procedures in, adult numeracy work, with a view to informing future development activity. Participants included numeracy learners, numeracy tutors, adult literacy organisers (ALOs), and adult education officers (AEOs). Interviews aimed to ascertain their views on adult numeracy policy and practice and guidance for future development. 47 interviews and focus groups were conducted altogether, with 9 individual interviews and 38 focus groups encompassing the following participant combinations:

- AEOs and / or ALOs
- Tutors and ALO/AEOs
- Tutors
- Adult learners

A content analysis of interview transcripts was guided by the following research questions:

RQ1: How do adult learners and tutors conceptualise numeracy?

RQ2: How are adult learners recruited; how do they access courses; and what barriers do they experience?

RQ3a: How are programmes planned; what activities are offered and how are they experienced by adult learners?

RQ3b: How important is accreditation?

RQ4: What are the benefits experienced by adult learners (of participating in courses)?

RQ5: What qualities, skills and knowledge do tutors need to work well in adult numeracy?

Research Findings

Survey findings

The main findings from analysis of survey responses are summarised below.

- Substantially more adults attended integrated numeracy courses than standalone numeracy courses.
- The majority of ETBs (78.6%) reported that the provision of numeracy courses was sufficient to meet demands in their region.
- There was much variation in the number of adult numeracy courses offered across the different ETBs (ranging from 720[2] courses to 12 courses across the 14 ETBs that responded to this question).
- It was found that ETBs tended not to offer once-off numeracy courses or activities, with 85.7% of respondents stating that these were not offered in their ETB.
- When evaluating the positive outcomes of adult numeracy initiatives, ETBs had gathered more anecdotal evidence than quantitative evidence. Conversations between tutors and learners were the most common way that anecdotal evidence was collected across the majority of ETBs surveyed.
- All of the ETBs provided accredited numeracy courses (generally ranging from QQI Levels 1–4), with QQI Level 2 being the most common.
- An initial assessment of adult numeracy was generally carried out by an ALO and/or a tutor. Following this, summative assessment was carried out by a tutor.
- Nearly all of the adult numeracy programmes were evaluated, generally by course participants and course tutors.
- A wide range of groups are involved in adult numeracy courses. The median number of participants in such courses was 310, with more women than men generally attending. On average, 71% of learners complete the course and 70% progress to other adult learning.[3]
- There were some numeracy activities organised in partnership with other groups or organisations, most commonly local schools, local community groups, and HSCLs.
- Adult numeracy is predominantly dependent on part-time numeracy tutors. Only three ETBs had full-time staff members involved in adult numeracy. By and large, there was training available for adult numeracy tutors in each ETB, with 47% of those working in adult numeracy having received training in the past year.

Interview findings

Conceptualisation of numeracy

Two different conceptualisations of numeracy were evident. The first sees numeracy as foundational for trades/craft apprenticeship. In such cases, numeracy would be taught as standalone courses to apprentices who had particular gaps in their mathematical knowledge. Similarly, such courses were usual for adults in other FET programmes who required dedicated

2 The provision of 720 courses in the case of one ETB appears to be significantly higher than reported provision elsewhere, however the research team have confirmed that this is accurate and reflective of a high volume of reported adult numeracy attendance during the year 2018.

3 "These values reflect two successive but separate questions in the survey 'What is the average number of adults who completed the course?' and 'What percentage of adult numeracy learners per year progress to other adult learning?'

tuition on foundational principles of numeracy. The second is functional numeracy, taught in an integrated fashion to adults who are disadvantaged in everyday life by unmet numeracy needs.

Learner recruitment, access, barriers

A variety of recruitment strategies were reported, including print/radio/television advertising, referrals from Government departments e.g., DEASP, home–school liaison officers or programmes, and liaison with other community groups. Affective reactions, such as fear, anxiety, stigma, and lack of confidence, represent the main barrier to access experienced by adult learners. Family commitments and lack of transport were also cited as barriers by some respondents.

Programme planning and activities offered to adult learners

Planning was generally flexible and responsive to learners' needs. Learning activities described by tutors were mostly practical, contextualised, and flexible in responding to adult learner interests and needs, including those of apprentices in specific trades. Adult learners appreciated tutors' kindness and approachability, as well as the non-threatening learning environment that usually contrasted with their prior experience of learning in school.

Accreditation

There were mixed responses from ETB staff regarding the importance of accreditation. While this was not always considered to be a top priority for adult learners, it was acknowledged that those who did progress to higher-level courses gained great satisfaction and affirmation from formal accreditation and certification.

Benefits

Overwhelmingly, the main benefit of participating in courses was the life-changing increase in confidence experienced by adult learners. Coupled with this confidence boost was the recognition by adult learners that they had developed new knowledge and understanding. Additional benefits included development of financial awareness and problem-solving skills, and the ability to support family members in numeracy tasks, such as helping children with homework. Some participants also referred to mental health and social benefits, since course attendance helped relieve feelings of isolation and social disconnection.

Qualities, skills, and knowledge needed by adult numeracy tutors

Personal qualities such as patience, communication skills, and understanding of the previous learning difficulties experienced by adult learners were regarded as more important than qualifications in mathematics. However, tutors do need a form of professional knowledge best described as "mathematical knowledge for teaching", which involves knowledge of students, knowledge of how students learn mathematics, deep understanding of fundamental mathematical concepts, and knowledge of flexible teaching strategies.

Conclusions

The interview analysis highlighted consequences of low levels of performance in numeracy for employment, health, and intergenerational disadvantage amongst the adult learners. There was also strong evidence of affective responses to numeracy challenges in the feelings of fear and shame that made adults reluctant to access programmes designed to help them. Many participants pointed to adults' prior experience of learning mathematics at school as the cause of these damaging emotions. In contrast, the adult numeracy teaching approaches described by all interview participants aimed to build conceptual understanding in real-life contexts, consistent with contemporary research literature in mathematics education.[4]

Recommendations

These evidence-based recommendations are intended to further strengthen current practice and extend the many benefits experienced by adult numeracy learners. Adult learners who were interviewed expressed appreciation for the numeracy programmes and the support received from tutors. Tutors were clearly committed, experienced, and sensitive to the specific needs of adult learners. The recommendations are intended to assist the ETBs in building on this strong foundation.

1. Identify and work with a definition of numeracy underpinned by contemporary research

A common understanding of numeracy needs to be developed across the sector, especially in relation to adult numeracy. A single, research-based numeracy framework would support more effective planning and delivery of numeracy programmes, while facilitating communication and promotion of numeracy to the general public. A numeracy framework would need to be integrated with other existing frameworks for curriculum development, assessment, and quality that inform adult literacy and numeracy provision, as outlined in NALA's (2012) Guidelines for Good Adult Literacy Work.

4 SOLAS, NALA ETBI 2020: Enabling Intergenerational Learning: Background Report on Family Literacy Practices in Irish Education and Training Boards (ETBs), p105

2. Promote the distinctness and importance of numeracy

Numeracy needs to be widely promoted as being distinct from, but related to, the mathematics learned at school. Numeracy is not a subset of literacy; it is a distinct concept with its roots in mathematics. Numeracy is embedded in everyday life – in the home, at work, and in community settings. Numeracy is "everywhere", and most people are more adept at using mathematics in their everyday lives than they realise. However, there may be persistent conceptual gaps that curtail numeric activities.

3. Provide adequate resourcing for coordination and delivery of adult numeracy programmes

None of the ETBs that participated in the survey research had appointed a numeracy coordinator, and none reported a separate numeracy budget. Given the large number of adult numeracy courses offered across the sector, the serious and varied consequences of unmet numeracy needs amongst the adult population, and the low levels of numeracy of Irish adults identified by the most recent PIAAC results, there is a need for greater emphasis to be placed on coordination and resourcing of adult numeracy programmes.

4. Recognise the numeracy demands and numeracy learning opportunities of all ETB courses

Since numeracy is embedded in everyday life, provision for adult numeracy should be integrated into all ETB programmes and not only those labelled as numeracy. This means that all adult education tutors need to be able to recognise the numeracy demands and opportunities in the courses they teach.

5. Establish clear and agreed ways to measure and track success at the local level

Accreditation serves many useful purposes, and adults who are awarded a certificate at the end of a course more frequently experience great pride and satisfaction at this achievement. However, there was a consensus amongst ETB staff that emphasis on accreditation should be balanced with learner goals and that learner ambitions be honoured at all times (whether those ambitions are for certification or otherwise).

6. Develop a wider range of numeracy assessment approaches

SOLAS/ETBI have published good practice guidelines on initial and ongoing assessment of literacy and numeracy in ETBs (SOLAS, 2018a). Such approaches to initial and ongoing assessment help to determine learner skill levels and needs. As stated in the ETBI/SOLAS guidelines, there is value in ETBs expanding the numeracy assessment repertoire used in initial screening over time, and continuing to use a wide range of numeracy assessment approaches to collect evidence of adult learners' progress.

7. Support tutors in finding, evaluating, and adapting resources for adult numeracy

A number of ETBI/SOLAS/NALA reports call for a central repository of resources for adult literacy, numeracy and language. However, collections of online resources already exist – for example, the *ETBI FET Digital Library* at https://library.etbi.ie/home. and the NALA Tutors Information Hub available at https://www.nala.ie/tutors/. Thus, greater attention should be given to promoting and sharing these resources, while supporting tutors to select, evaluate, and adapt resources to suit their learners' needs. Good-quality adult numeracy resources can also be adapted from existing materials designed for younger learners. All resources should be accompanied by guidelines showing tutors how to modify them to suit their learners' needs and interests. Development of resources should be informed by the common numeracy framework referred to in Recommendation 1. A professional development programme should be designed and delivered to complement these resources and adaptation guidelines.

8. Ensure adult numeracy tutors are appropriately qualified

Adult numeracy tutors need personal qualities such as patience, empathy, and good communication skills. They also need to have adequate mathematical knowledge for teaching, comprising knowledge of adult learners' abilities and needs, knowledge of how people learn mathematics, deep understanding of fundamental mathematical concepts, knowledge of flexible teaching strategies, and the ability to "see" numeracy in the world around them.

9. Provide numeracy-specific professional development

Providing professional development for adult numeracy tutors was identified as a pressing need by interviewees participating in this study. Professional development needs to be widely promoted and accessible to tutors, and this could be done by offering regional workshops and informal meetings in different locations throughout the country as well as via online webinars. The professional development may involve tutors in sharing their practice as well as learning new teaching approaches. Professional development should be coordinated with the aim of establishing communities of practice across the ETBs while raising the profile of adult numeracy provision.

Guidelines at a Glance

The guidelines are not intended to prescribe what ETBs "must" do. Instead, they set out broad guiding principles for good practice in adult numeracy that invite reflection, discussion, and interpretation in light of local needs, contexts, and resourcing. The guidelines also aim to build on the ETBs' existing good practice in adult education, in particular the strong learner-centred ethos and adult learning approaches that value relevant content, situational and experiential learning, and adult learners' input into planning and evaluation of their learning.

1. Taking time to think about numeracy

1.1 Agree on a definition of numeracy that meets contemporary needs

Our understanding of numeracy has changed over time, going from a type of quantitative numeracy to the later conception of accessing, interpreting and using mathematical concepts for a wide variety of life activities.

1.2 Go deep and wide with application of numeracy

Numeracy in the 21st century involves critical thinking, working with representations and tools, and applying mathematical knowledge confidently in a range of contexts including, but by no means limited to, financial management. In an increasingly complex and information-drenched society, numerate citizens need to decide how to evaluate quantitative, spatial or probabilistic information used to support claims made in the media or other contexts. They also need to recognise how mathematical information and practices can be used to help develop opinions about social or political issues.

2. Placing the learner at the centre

2.1 Define success with the learner

Adult learners should be consulted about appropriate ways of measuring their success in numeracy learning. There are also different ways to recognise achievement. Accreditation might not the highest priority for adult numeracy learners who are more interested in developing practical life skills than in obtaining a certificate. However, accreditation can serve many useful purposes and adults who are awarded a certificate at the end of a course often experience great pride and satisfaction at this achievement.

2.2 Acknowledge long-held sensitivities around numeracy

Learner-centred adult numeracy delivery acknowledges adults' diverse goals and needs. Tutors and ETB staff also need to be sensitive to the possibly damaging effects on adults of their school mathematics learning experiences. Creating a comfortable and safe learning environment is especially important when working with adults who have developed a view of mathematics as involving memorisation of facts, formulas, and procedures.

2.3 Help the learner recognise and value their prior skill and knowledge

Adult learners often reinforce their self-perceptions of low levels of numeracy skills by dismissing their own numerate behaviour as mere "common sense" or as something that does not involve mathematics at all. Tutors need to recognise and value adults' informal, and often invisible, numeracy practices. These practices can then be discussed and related to the more formal approaches used in the school mathematics classroom.

2.4 Honour learner ambitions

While many adults are seeking to develop the numeracy knowledge and skills needed for specific trades and jobs, others are motivated by a desire to help their children learn mathematics, to be able to make financial decisions and manage their household budget, and especially to overcome their fear of mathematics. ETB staff can acknowledge and celebrate the variety of benefits experienced by adults who participate in numeracy programmes.

3. Designing and delivering adult numeracy programmes

3.1 Be alert and responsive to varying degrees of unmet numeracy need

Each ETB will offer a menu of courses, depending on the resources available to them and the needs of the adult numeracy learners with whom they work. These may range from standalone courses designed for teaching apprentices the mathematics relevant to their trade, to integrated courses that teach numeracy knowledge and skills within everyday contexts that are immediately relevant to the adult participants. Even when adults are looking for courses in areas other than numeracy, it is important for ETB staff to be alert to opportunities for identifying their numeracy learning needs and directing them into integrated courses with a numeracy focus.

3.2 Clearly define and communicate the numeracy demands of programmes

Whether or not they are labelled as a "numeracy" course, many of the courses offered by an ETB will have specific numeracy demands. Adult numeracy practitioners need to be aware of the numeracy demands of the courses they teach, and to be able to work with colleagues who teach other courses to capitalise on the numeracy learning opportunities within these courses.

3.3 Offer context-rich and meaningful numeracy

Numeracy activities should draw on meaningful contexts, build mathematical understanding, and make connections between different areas of mathematics and between mathematics and the real world. Effective adult numeracy tutors are adept at identifying their learners' interests and needs and using these as meaningful contexts for numeracy development.

3.4 Ensure concepts are understood and applied

Good numeracy teaching practice develops conceptual understanding as well as knowledge of facts and proficiency with calculation skills. Four important aspects of understanding that can be emphasised are: making connections, applying familiar knowledge in new contexts, translating between representations, and explaining mathematical thinking.

3.5 Select, adapt, and create adult numeracy learning resources

Adult numeracy practitioners will develop resources embedded in real-life contexts to suit learners' needs. Resources are also available through the *Tutors information hub* on NALA's website. Resources originally designed for children can often be adapted for older learners.

3.6. Draw on good practice guidelines when assessing numeracy

ETBs will develop local criteria for success in their adult numeracy programmes. Assessment can be informal and contextualised and follow the already established good practice guidelines published by SOLAS and ETBI (2018), as well as NALA (2012).

3.7 Evaluate courses for effectiveness

Evaluation seeks to answer questions such as "Did that work?" and "Could it work better?". Evaluation should engage and seek input from all stakeholders, clients, collaborators, and partners. As well as observing adult learners' reactions to the programmes in which they are involved and documenting changes in their knowledge and skills, an evaluation might make use of data on adult learners' backgrounds and their engagement and progression as measures of success.

4. Supporting and developing adult numeracy tutors

4.1 Plan for adult numeracy tutors' professional development

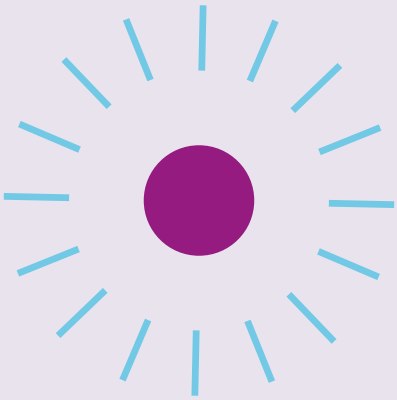
Adult numeracy tutors need to possess excellent understanding of elementary mathematics; digital literacy skills; understanding of programme design, development and assessment; and "mathematical eyes", or a view of mathematics as part of everyday life. ETBs should consider ways of supporting adult numeracy tutors to develop these qualities, and of making such opportunities accessible to tutors in their local area while avoiding costs to tutors in terms of time and financial commitment.

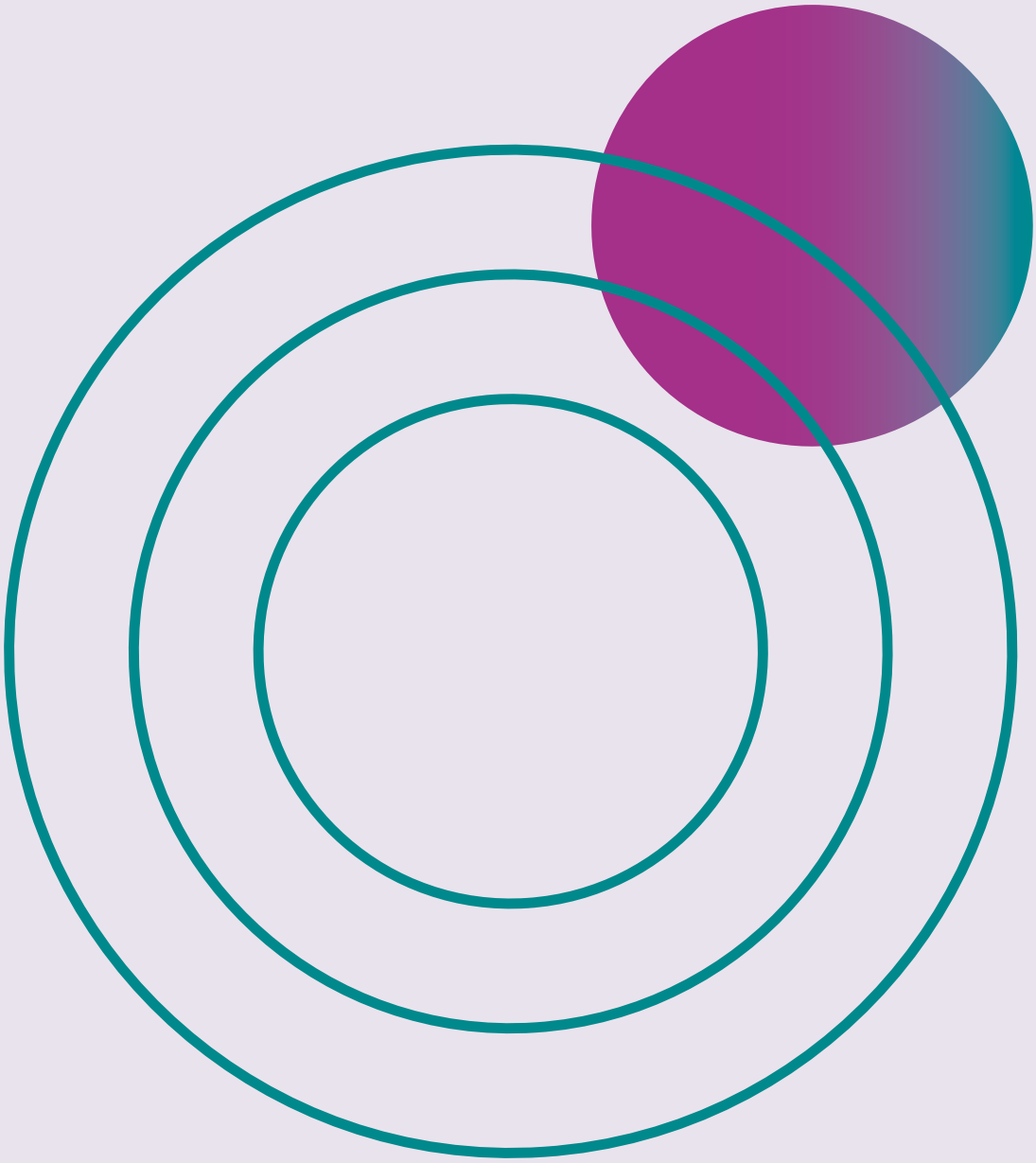
4.2 Create networking opportunities for adult numeracy tutors

Most adult numeracy tutors work part-time or are volunteers, and as a result may feel isolated from peers in their own or other ETB locations. Face-to-face and online networking opportunities can bring tutors together for discussion and demonstration of different teaching materials and approaches to suit various types of adult learners, and for sharing of information about how numeracy is integrated into other courses such as horticulture or hospitality. Such meetings could help establish communities of practice across the ETBs while raising the community profile of adult numeracy provision.

Conclusion

The meaning of numeracy has changed over time, just as the numeracy demands of life and work in the 21st century are constantly changing and evolving. Adult numeracy provision should be responsive to these dynamic conditions while taking account of adult learners' needs and interests. These guidelines go some way towards recognising existing good adult numeracy practice and supporting tutors in designing context-rich numeracy experiences that enrich the learner experience and build learners' confidence and competence.





Introduction

The aim of this research was to capture and document standalone and integrated adult numeracy activity in the Education and Training Board (ETB) context, in order to develop good practice guidelines and inform future development of adult numeracy policy and practice.

From April to November 2019 the study mapped the provision of adult numeracy across the 16 ETBs that deliver adult further education and training (FET) in Ireland. A survey was distributed to each of the 16 ETBs to establish the range and depth of adult numeracy activity in each ETB area. Site visits were also made to each ETB for interviews with numeracy tutors, adult literacy organisers (ALOs), and adult education officers (AEOs), and focus groups with adult numeracy learners. We analysed all of this evidence and now we present the findings and what they suggest about effective ways to support adult numeracy learning in the FET sector.

The Further Education and Training (FET) sector in Ireland places a strong emphasis on improving the skills of adults, including adults' numeracy skills (SOLAS, 2014; NALA, 2017). NALA's (2012) Guidelines for Good Adult Literacy Work describe numeracy as "a life skill that involves the competent use of everyday mathematical language, knowledge and skills, and the confidence to manage the mathematical demands of real-life situations" (p. 8).

Why does Adult Numeracy Matter?

Numeracy is grounded in everyday contexts that adults experience in their lives and work. Research has shown that adults who struggle with numeracy are more likely than others to earn less income, have trouble finding employment, and suffer from poorer physical and mental health (Carpentieri, Litster, & Frumkin, 2010; Parsons & Bynner, 2005; Tout et al., 2017). Low numeracy levels amongst adults can also contribute to intergenerational cycles of inequality and disadvantage in families (Carpentieri, Cara, & Litster, 2013). The OECD's (2013a) most recent international survey of adult skills found that around one-quarter of Irish adults scored at the lowest level of the numeracy scale. Provision of adult numeracy support is therefore a priority for addressing economic and social disadvantage.

How the Report is Organised

The results of the study are presented in five chapters.

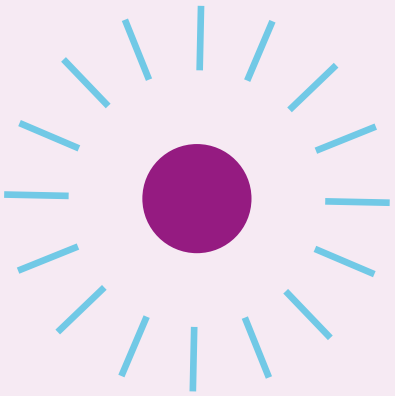
Chapter 1 examines the national and international literature in relation to adult numeracy policy, practice, and research.

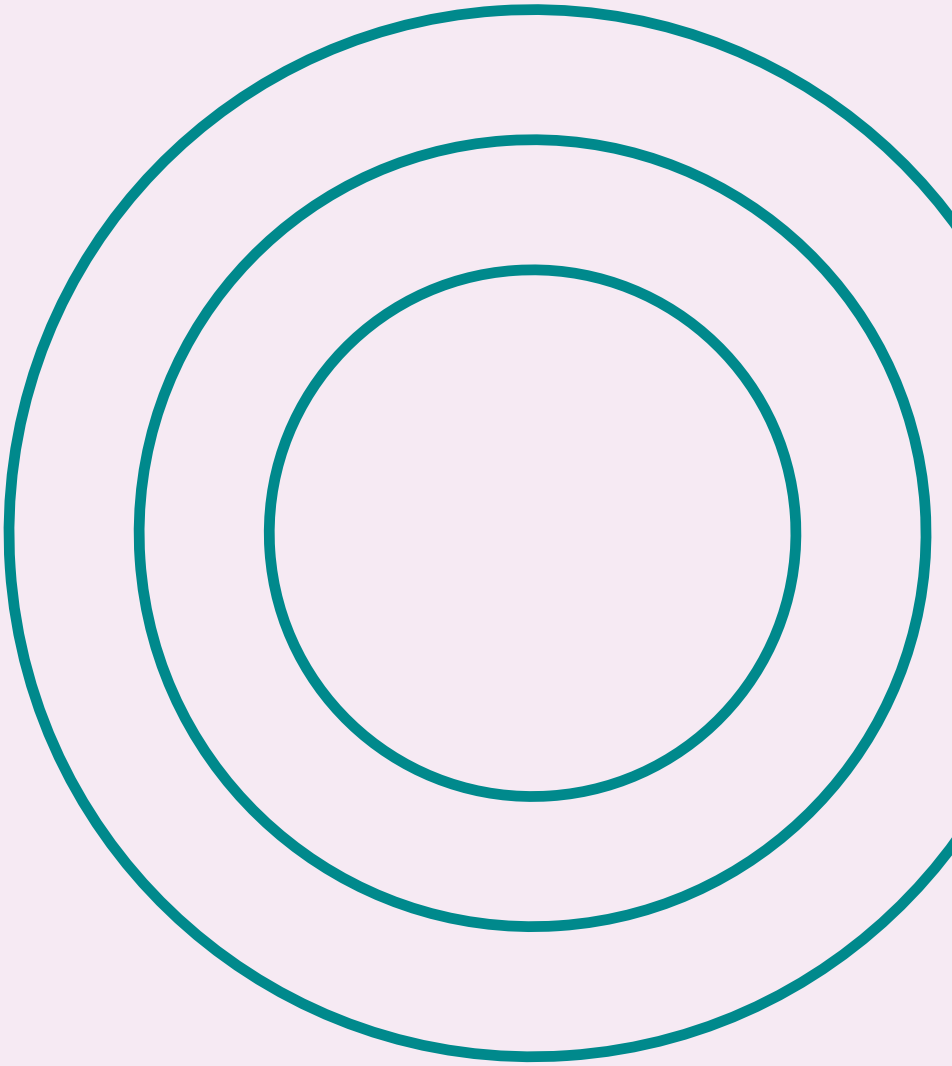
Chapter 2 presents a quantitative analysis of survey responses from the 16 ETBs.

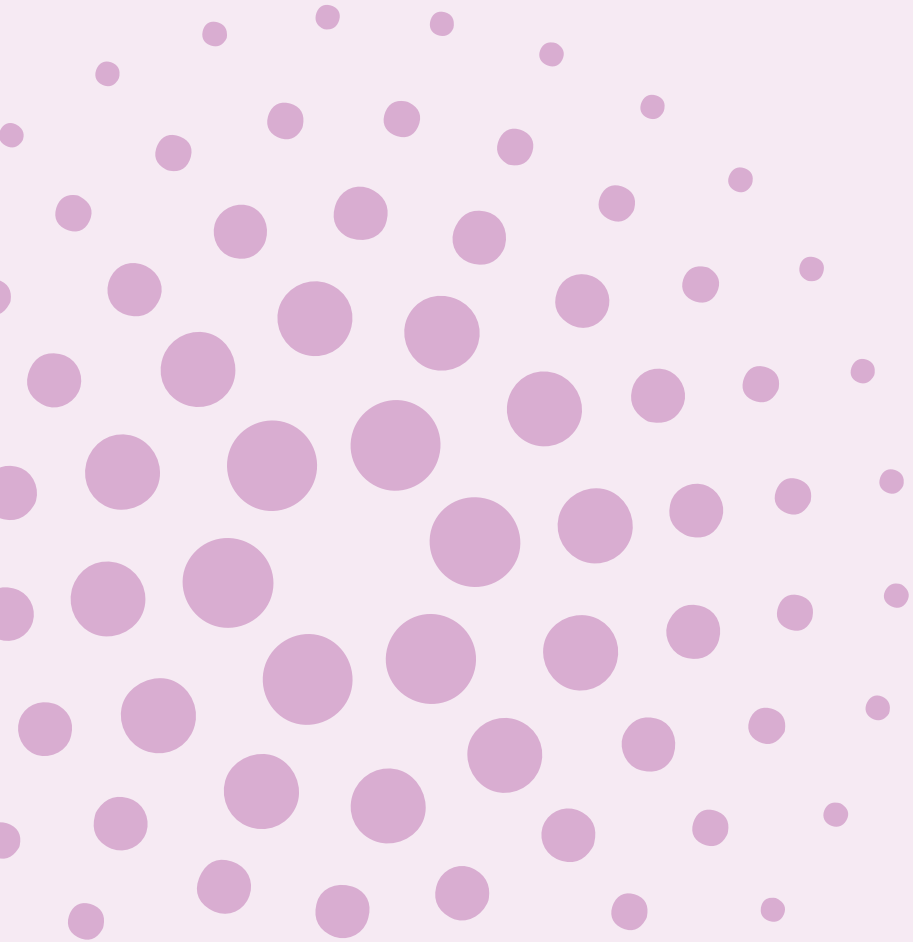
Chapter 3 presents a qualitative analysis of the 47 interviews and focus groups that were conducted with adult numeracy learners, numeracy tutors, adult literacy organisers, and adult education officers. A total of 38 focus groups and 9 interviews were conducted as part of this research.

Chapter 4 presents recommendations for further strengthening current adult numeracy practice.

Chapter 5 proposes guidelines to develop good FET adult numeracy in terms of organisation, practice, and positive outcomes.







Chapter 1.
A Review of National and International Policy and Practice Literature on Adult Numeracy

Understanding Adult Numeracy

Recently in Ireland, the Further Education and Training (FET) sector has developed a strategy which puts a strong emphasis on improving the skills of adults, including adults' numeracy skills (Further Education and Training [FET], 2014; NALA, 2017). However, adult numeracy is not well defined (Griffiths & Stone, 2013; Kaye, 2018). This literature review surveys contemporary adult numeracy research with the aim of informing good practice guidelines and future development of adult numeracy policy and practice in Ireland. It examines definitions of numeracy; existing policies and practices for developing adult numeracy skills, both internationally and nationally; the numeracy performance of adults; and challenges arising as a result of these developments.

The starting point for this review focuses on the need for an agreed definition of "adult numeracy" by considering two questions: (1) Which *adults* are participating in numeracy programmes and why? (2) What is meant by *numeracy*?

Which adults?

Regarding the first question, from the literature on teaching adult numeracy in its various guises we can identify four scenarios in which adults are engaged in improving their mathematical skills. Each of these scenarios is linked to a different educational, economic or social purpose and has a different research history. The scenarios presented below may seem like a forced distinction. Arguably, there is shared ground between scenarios and more than one scenario is reflective of further education and training. We use the four scenarios to better distinguish between the types of unmet numeracy need experienced by different learners.

Scenario 1 involves adults who had difficulties learning mathematics in a formal school environment. These individuals are typically participating in adult basic education courses for personal development purposes, to enable them to function effectively with respect to numeracy in their everyday lives.

Scenario 2 involves adults who are preparing for or working in a trade or profession that has mathematical requirements. Their numeracy learning is thus driven by industry needs, and researchers in this field are interested in how mathematics is applied in workplace tasks and contexts.

Scenario 3 is concerned with the mathematical requirements of higher education programmes, such as university or college diplomas and degrees. Adults who are seeking entry to such programmes, but are poorly prepared in mathematics, often need to access mathematics learning support either before or during their programme of study.

Scenario 4 involves enhancing public engagement with mathematics for the purpose of developing mathematically literate citizens. Here the targeted participants comprise the general adult population rather than any specific disadvantaged or vocational group.

While each of these four scenarios could be interpreted as involving adult numeracy, it is only Scenario 1 that is addressed in this report. There is scope in further research to more fully address the numeracy most associated with Scenario 2.

Which numeracy?

Exploring the second question, concerning the meaning of numeracy, uncovers the ambiguous nature of this term due to the multitude of definitions and conceptions in use. Moreover, these different definitions can be used interchangeably by some, while others make clear distinctions between them (Vacher, 2014). Coben and Alkema (2018) propose that there are two contrasting ways to conceptualise numeracy, either as a technical skill or a social practice. They claim that numeracy policy literature is more consistent with the former definition, concentrating on numeracy for economic development, while numeracy research literature is more likely to investigate the social manifestations and consequences of numeracy in home, work and community settings. The tension between these conceptualisations of numeracy permeates the existing literature in the field, resulting in an approach to research and policy-making that often lacks coherence.

Defining Numeracy

Numeracy

Numeracy has an array of different meanings for different people. Frejd and Geiger (2017) found that there are many interpretations of numeracy, but there is a no one unified definition for the term. Numeracy is described in both Irish and international educational policy documents as the basic mathematical skill embedded in the description of literacy (An tSeirbhis Oideachais Leanunaigh agus Scileanna [SOLAS], 2014; Department of Education and Skills [DES], 2013; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2006). Gal (2016) reports that numeracy is sometimes referred to as a skill that is learned primarily

in school, while others believe numeracy is part of the mathematics curriculum. Madison and Steen (2008) discuss how the term numeracy came to refer only to simple arithmetic skills, normally attained in the early years of life; for many people this definition persists, in that numeracy has a limited meaning. However, Goos, Geiger, Dole, Forgasz and Bennison (2019) argue that this "basic skills" idea of numeracy is outdated. They offer an alternative and much broader definition of numeracy which captures many different aspects of knowledge and skills needed by a numerate person in order to engage with the world as an informed citizen in the 21st century.

Numeracy and mathematical literacy

The concept of numeracy was first introduced in 1959 in the UK Crowther Report, in which the word "numerate" was defined as "a word to mirror the image of literacy" while including the skill to think quantitatively (Ministry of Education, 1959). Later, the Cockcroft (1982) report defined the word "numerate" as having two attributes: "The first of these is an 'at-homeness' with numbers and an ability to make use of mathematical skills which enables an individual to cope with the practical mathematical demands of his everyday life" and the second characteristic is the ability to "have some appreciation and understanding of information which is presented in mathematical terms, for instance in graphs, charts or tables" (p. 11).

Not only are there many definitions of numeracy, but there also exist comparable terms such as mathematical literacy or quantitative literacy, depending on the country or jurisdiction. Quantitative literacy is the term used in the United States to describe the ability of a person to work effectively with quantitative data in all aspects of life. The Quantitative Literacy Design Team (2001), which developed this notion, acknowledged that quantitative literacy also includes positive dispositions towards mathematics and an appreciation for the use of mathematics in society. They argued that numeracy plays a vital role in cultivating informed citizens and supporting democratic government. However, the Quantitative Literacy Design Team noted that, although people believe quantitative literacy to be important, there is little agreement on one unified definition, which would seem to echo findings noted earlier in this review and is worthy of further exploration.

Mathematical literacy is a relatively new term that has emerged from the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA). The OECD's PISA definition of mathematical literacy has advanced from a basic skills conception of being able to use the mathematics learned in a school setting and apply it to everyday life, to a much broader way of thinking about mathematical literacy as:

> *an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognise the role that mathematics plays in the worlds and to make well-founded judgements and decisions needed by constructive, engaged and reflective citizens. (OECD, 2016a, p. 65)*

PISA is designed to assess 15-year-old students' ability to use the mathematical knowledge gained in school to solve problems in real-world settings outside school. Therefore, mathematical literacy, in the context of PISA, is linked to mathematics learning during the school years.

In contrast to PISA, the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) focuses on essential skills for adults living and working in the world: literacy, numeracy, and problem solving in technology-rich environments (Tsatsaroni & Evans, 2014). PIAAC defines numeracy as "the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life" (PIAAC Expert Numeracy Group, 2009, p. 21). This definition of numeracy is further elaborated by a definition of "numerate behaviour", which is described as "managing a situation or solving a problem in a real context, by responding to mathematical content/ information/ideas represented in multiple ways" (p. 9). However, a recent review of the numeracy construct and assessment in PIAAC has identified several areas for improvement, including elaboration of the definition of adult numeracy used in the framework (Tout et al., 2017). The review team recommended that the following theoretical developments in research into adult numeracy should be incorporated into the existing PIAAC framework:

- dispositions to use mathematics
- the ability to see mathematics in a numeracy situation
- critical reflection
- degree of accuracy (p. 48).

They also recommended that the PIAAC framework should give more attention to digital and technological representations and tools, and that other numeracy models – in particular the PISA problem-solving model and the model for numeracy in the 21st century (Goos, Geiger, & Dole, 2014) – should be used to refine the PIAAC definition of numeracy.

Jablonka (2015) claims that numeracy and mathematical literacy have become part of international educational and economic discourses broadcast by governments and supranational organisations. Yet the OECD usage of these terms implies subtle differences in their meanings: mathematical literacy describes the ability of 15-year-old students to demonstrate the mathematical knowledge developed in school for use in everyday life, while numeracy refers to competencies displayed

Dimension	Attributes
1. Quality of desired outcome	Ability to make use of some skills (basic)
2. Knowledge	Mathematics/mathematical and arithmetic/quantitative and logical (arithmetic–mathematics-logic spectrum)
3. Display of expertise	Understand and appreciate and cope (passive, reactive)
4. Context	Information and practical situations (daily life, possibly work)

Table 1: Four Dimensions of Numeracy (Karaali et al., 2016)

by adults. These different usages might reinforce the notion that mathematical literacy requires knowledge gained in a school setting, while numeracy is a basic skill needed by adults who might not have gained sufficient mathematical knowledge during the compulsory years of schooling.

Although it can be argued that numeracy and mathematical literacy are not the same, Liljedahl (2015) notes that both terms are generally seen to involve the ability to use mathematical knowledge, tools and dispositions in a range of real-life situations. Thus one could conclude that a numerate person should be capable of budgeting, making decisions about their personal circumstances and working with others or as part of a team, especially in the workplace. However, Niss and Jablonka (2014) describe mathematical literacy as a concept which is positioned in student and school contexts, whereas numeracy is described as applying within "adult world contexts". The debates surrounding the meanings of numeracy and mathematical literacy need to acknowledge that not only have these terms come into existence at different times but they are also assumed to operate within somewhat different contexts, involving different combinations of school, workplace, and daily life.

Researchers such as Maguire (2003) conceptualise numeracy as multi-dimensional, describing variations in the "sophistication of numeracy" along a continuum of three phases. The first, formative, phase introduces a limited concept of numeracy as basic arithmetic skills. The second phase is described as mathematical, in that the concept of numeracy is equated with mathematics. The third phase describes a more complex and integrative conceptualisation of numeracy that incorporates "the mathematics, communication, cultural, social, emotional and personal aspects of each individual in a particular context" (Maguire & O'Donoghue, 2004, cited in NALA, 2013a, p. 14). While Maguire (2003) explicitly refers to varieties of numeracy as lying on a continuum, this approach is specifically designed for the recognition and positioning of adult numeracy capabilities – which again highlights the common usage of numeracy in relation to adult contexts.

Karaali, Villafane Hernandez, and Taylor (2016) analysed various different definitions for numeracy and concluded that it can be defined in four domains: Quality of desired outcome, Knowledge, Display of expertise, and Context. They proposed that within all the definitions they analysed there is a common theme of using mathematical knowledge to deal with situations in the real world.

Karaali et al. (2016) also argued that there are differences between numeracy and quantitative literacy related to different levels of mathematical ability, as described in Table 1. Numeracy is described as the basic or foundational level of mathematical skills that students learn in primary school. Quantitative literacy, however, is the intermediate level in such a hierarchy. Quantitative literacy captures all of numeracy and goes beyond numeracy, to a higher level of comprehension and logic. It is the intermediate level that Karaali et al. have suggested students should attain in post-primary school when they have fully understood the concept of numeracy. This conceptualisation is similar to that of Maguire's (2003) theory of sophistication in that numeracy is defined in a hierarchical or progressive way, from basic arithmetic to thinking and analysing mathematically.

In contrast to definitions of numeracy that rely on different levels of sophistication or operation in different domains, Goos et al. (2014) developed a different kind of multi-dimensional model of numeracy for the 21st century. Their numeracy model was influenced by the work of Hogan (2000), while also including the characteristics of numerate behaviour as described by the OECD. The model (shown in Figure 1) gives a detailed description of what numeracy involves and what it means to be numerate.

The numeracy model of Goos et al. (2014) consists of four different domains which are grounded in a fifth domain known as critical orientation. The model is described as understanding where one can apply mathematical knowledge in real-life contexts by using different representational, physical or digital tools while holding positive dispositions. These four domains are grounded in a critical orientation which involves the ability to make decisions and form opinions based on these four domains. This view of numeracy goes beyond what is needed for either school students or adults only to learn mathematics; instead, it proposes a detailed

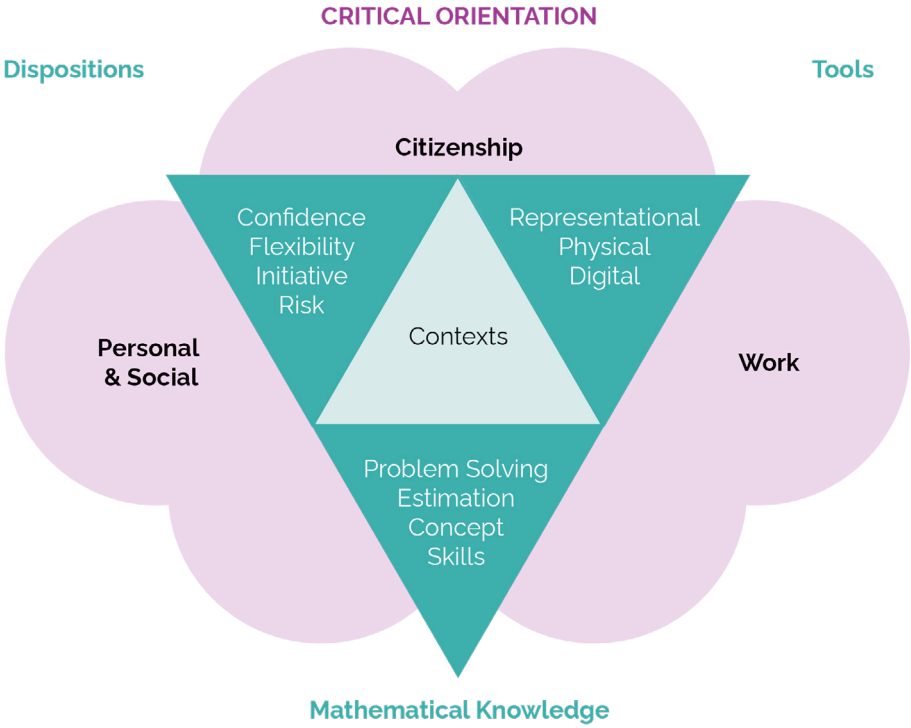


Figure 1. A model for numeracy in the 21st century (Goos et al., 2014).

description of what numeracy entails in the 21st century. The PIAAC review team recommended that this model be used to refine the PIAAC definition of numeracy and description of what constitutes numerate behaviour (Tout et al., 2017).

Numeracy as a technical skill

In Ireland there has been a drive to improve the numeracy capabilities of both young people and adults (DES, 2011, 2016). In the national literacy and numeracy strategy for schools, numeracy is defined as follows:

> *Numeracy encompasses the ability to use mathematical understanding and skills to solve problems and meet the demands of day-to-day living in complex social settings. To have this ability, a young person needs to be able to think and communicate quantitatively, to make sense of data, to have a spatial awareness, to understand patterns and sequences, and to recognise situations where mathematical reasoning can be applied to solve problems (DES, 2011, p. 8).*

While it is not surprising to see the emphasis on school mathematics curriculum topics in the definition above, Ireland's National Skills Strategy 2025 instead expresses the need for a numerate workforce with the skills to develop and advance the country's economy (DES, 2016). This strategy sees numeracy as a skill needed by all people in order to participate fully in society and especially to access good jobs (NALA, 2017). In the context of adult literacy and numeracy, the previous FET Strategy (2014–2020) also echoed the need to "prioritise numeracy more strongly and increase the amount of numeracy provision offered as integrated and standalone options" (SOLAS, 2014, p. 100). Equally this remains an area of importance for FET as the 2020–2024 Strategy emerges against the backdrop of assistive technologies and digital advancements.

Much of the educational policy literature conceptualises numeracy as a technical skill that enables individuals to contribute to a nation's economic development and global competitiveness (Oughton, 2018). Within this technicist paradigm, there is also a role for numeracy in enhancing personal development and civic participation. For example, the OECD, government bodies and non-government organisations internationally and nationally encourage a strong emphasis on civic life for informed citizenship in the numeracy definitions they respectively promote. Thus countries around the world are striving to develop citizens who can use mathematical reasoning to engage with the demands of everyday life, whether this capability is referred to as mathematical literacy, numeracy or quantitative literacy. Frejd and Geiger (2017) explored the notion of mathematical literacy by reviewing different international curriculum documents. They discovered that while there is no broadly accepted definition of mathematical literacy, the focus of developing mathematical literacy is to "use mathematics to participate effectively in society and to contribute in a productive and critical manner" (p. 3). Their analysis highlights the crucial connection between developing numeracy through learning at school and using one's numeracy capabilities for productive citizenship in adult roles. Thus numeracy, when conceived as a technical skill, spans school and civic contexts and serves a range of goals, from economic productivity to social participation and individual well-being.

Numeracy as a social practice

There is now a growing body of research acknowledging that, similar to literacy, numeracy cannot be fully understood without taking into account the social, cultural and political contexts in which it is embedded (Hoyles, Wolf, Molyneux-Hodgson, & Kent, 2010; Reder & Bynner, 2008; Street, Baker, & Tomlin, 2005). Conceptualising numeracy as a social practice shifts attention to the social manifestations and consequences of numeracy in home, work and community settings. For example, Street's (1995) work opened up a different way of thinking about literacy and numeracy, the ways they are experienced, and the contexts in which they are used. By focusing on the ways in which people use literacy and numeracy in their lives, different forms are identified, including numeracy in the workplace, numeracy at home, and numeracy in school (Barton & Hamilton, 1998; Street, 1995). Seeing literacy and numeracy as social practices recognises that the value given to the different forms varies; that is, some forms of literacy and numeracy are more dominant, visible and powerful than others (NALA, 2012). Oughton (2018) argues that the social practice perspective on numeracy challenges the privileging of academic forms of numeracy over other forms that are embedded in people's daily lives.

Yasukaya, Rogers, Jackson, and Street (2018) offered a reason as to why, in recent years, numeracy has come to be seen as a social practice. They suggest that this conceptualisation of numeracy is most likely a consequence of the influence of socio-cultural theories in the field of mathematics education. They note that this perspective on numeracy focuses on what people do with numeracy in different social situations instead of how people engage with numeracy tasks out of context. One consequence of this view of numeracy as a social practice is that it sharpens the distinction between numeracy and mathematics: "Numeracy somehow involves the use of numbers, calculation or diagrams in social practice, whilst mathematics involves some degree of abstraction or concern with structure" (Barwell, 2004, p. 20). Oughton (2018) also argues that the social practice lens has consequences for the assessment of adult numeracy: in particular, the relevance and accuracy of test items used by PIAAC can be challenged since these items do not assess how individuals solve numerical problems in the authentic contexts they encounter in their everyday lives. Thus PIAAC test items are likely to underestimate adults' numeracy skills, and the actual levels of adult numeracy may not be as low as those reported in international studies.

Often the mathematics that adults use in their everyday lives or at work is not consciously perceived by them as being mathematical. Keogh, Maguire, and O'Donoghue (2018) found that many people fail to recognise the mathematical skills and knowledge they use every day in the workplace, instead dismissing this as mere common sense. In viewing numeracy through a social practice lens, one must ensure that numeracy does not become so embedded in everyday realities that it becomes invisible.

Adult numeracy

Internationally, despite substantial activity amongst policy-makers, adult/vocational education practitioners, and academics, the field of adult numeracy remains under-researched and under-theorised (Coben et al., 2003; FitzSimons, 2002; Galligan, 2013; Safford-Ramus, 2018). According to Swain (2005), this lack of a theorised understanding of adult numeracy is in contrast to the situation with adult literacy, where much more research has been conducted in recent years.

Attempts to understand numeracy highlight its complexity and multifaceted nature, and the field of adult numeracy is equally diverse and complex. In this report the focus of adult numeracy is on competencies that adults need to possess in order to effectively engage with numerical tasks in everyday life and work. Gal (2016) states that adults are faced with a variety of tasks where they need to employ their numeracy skills on many levels of difficulty and in a range of different contexts. This is different from the notions of numeracy or mathematical literacy as competencies learned and demonstrated by students in the mathematics classroom, but clearly there is a connection between one's mathematics learning experiences at school and one's later adult numeracy competencies. It has long been recognised that not all people who complete compulsory schooling are numerate. For example, Steen and colleagues noted that "Unfortunately, despite years of study and life experience in an environment immersed in data, many educated adults remain functionally innumerate" (Quantitative Literacy Design Team, 2001, p. 21). Nevertheless, there is a strong relationship between educational attainment and numeracy levels displayed by adults: analysis of Irish PIAAC data found that "almost half (49%) of the sample with level 1 or lower numeracy had lower secondary education or less" (NALA, 2017, p. 16).

Numeracy is often defined in terms of literacy, stemming from the first definition of numeracy as being "the mirror image of literacy" (Ministry of Education, 1959, p. 269). This is the case when it comes to adult numeracy in Ireland; for example, the NALA Strategic Plan (2020-2022) defines literacy as "listening, speaking, reading, writing, numeracy and using everyday technology to communicate, access services, and make informed choices" (NALA, 2020, p. 5). However, NALA has recognised the need for adult numeracy to be explicitly addressed. For example, NALA's (2012) Guidelines for Good Adult Literacy Work propose a definition of numeracy as "a life skill that involves the competent use of everyday mathematical language, knowledge and skills, and the confidence to manage the mathematical demands of real-life situations" (p. 8).

Yet researchers continue to argue that there remains a need for a clear and concise definition of what adult

numeracy entails (O'Donoghue, 2018). Within numeracy/education policy literature, numeracy is often referred to as mathematics for adults or as entailing adults learning mathematics (DES, 2016; FET, 2014). There is a need to clarify who is being taught, what is being taught, and in what institutions or in what contexts people are engaging in adult numeracy education, because all of this impacts on the implied definition of adult numeracy (Kaye, 2018). Considering numeracy only within the context of adult learning may overlook the need to develop numeracy from the earliest years and in all life contexts. Kaye (2018) also acknowledges that numeracy involves much more than the concept of "basic math" as it enables the kind of questioning or critical orientation that characterises active and informed citizenship.

Assessing Numeracy Performance

The international assessment of adult numeracy on a large scale has a relatively recent history (Geiger, Goos, & Forgasz, 2015). The first of such assessments can be traced back to the International Adult Literacy Survey (IALS), which was conducted in three phases (1994, 1996, and 1998) in 20 nations. This comparative survey measured the literacy and numeracy skills of a nationally representative sample of adults aged 16–65 from each participating country. Following on from this, the Adult Literacy and Life Skills (ALL) survey was an investigation of the distribution of certain skills, such as literacy, numeracy, and document interpretation. It followed a similar format to IALS and was first conducted in 2003, followed by a second round between 2006 and 2008. More recently, PIAAC has gathered international comparative data on adult numeracy competencies. This section analyses the assessment of adults' numeracy capabilities on an international level and compares the findings with results from the PISA assessments of mathematics literacy of 15-year-old school students. The various assessments and provisions for adult numeracy in Ireland are presented and the report from the latest strategy to integrate numeracy into the Further Education and Training sector, specifically in Ireland, is discussed.

Programme for the International Assessment of Adult Competencies

PIAAC, the survey of adult skills, assesses the proficiency of adults aged between 16 and 65 years in literacy, numeracy, and problem solving internationally. These are regarded as key skills that are important for adults to have in order to integrate and participate fully in society (OECD, 2016b). There were 56 numeracy items included the last PIAAC assessment, administered in 2012. Many of these items were previously used in the ALL survey; however, Ireland did not participate in ALL. The results from PIAAC (2012) showed that adults in Ireland had a mean score of 255 on the numeracy scale – significantly below the PIAAC average of 266 (Figure 2).

Furthermore, just over one-quarter (25.6%) of adults in Ireland scored at or below Level 1 on the numeracy scale. The numeracy proficiency scale is divided into

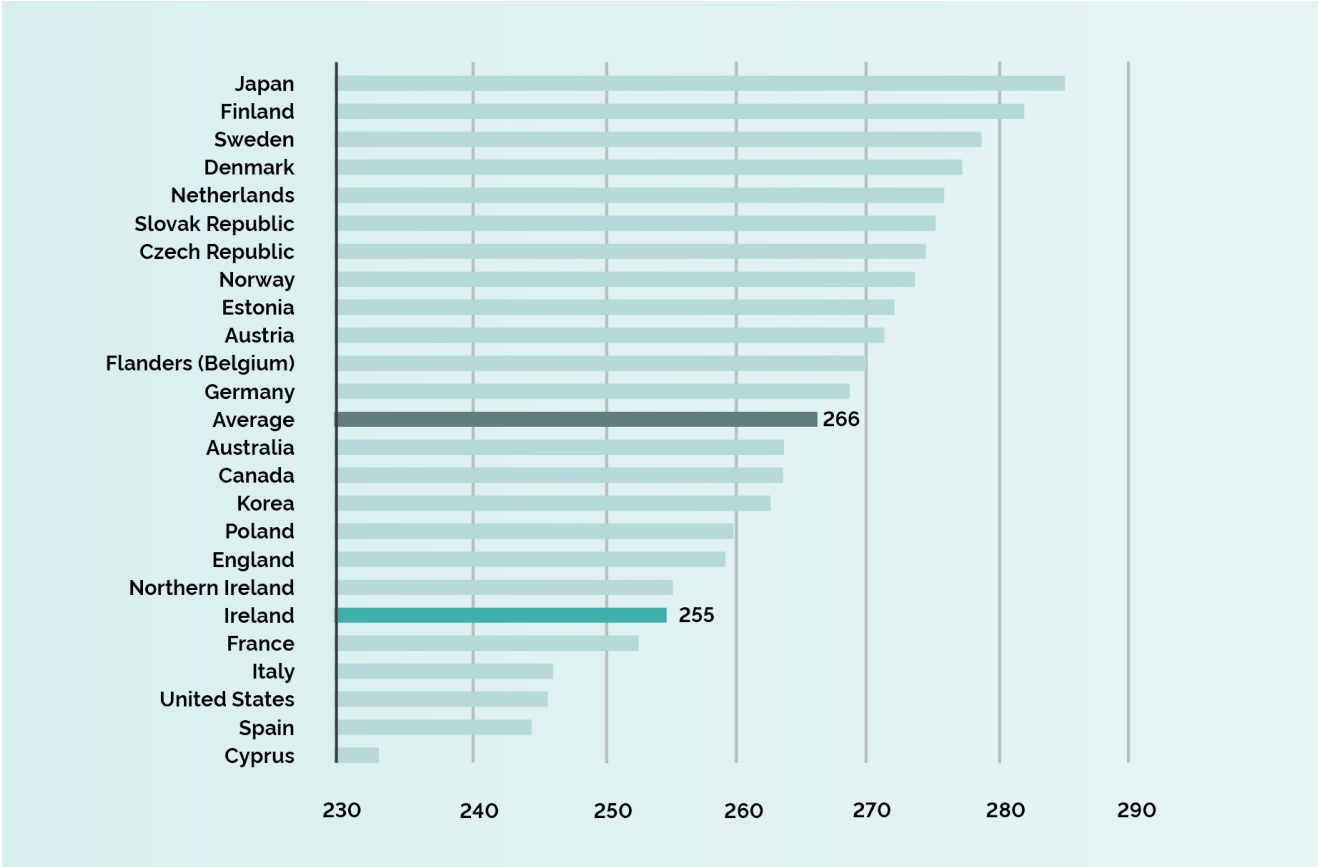


Figure 2. Numeracy (adjusted) mean scores, PIAAC 2012

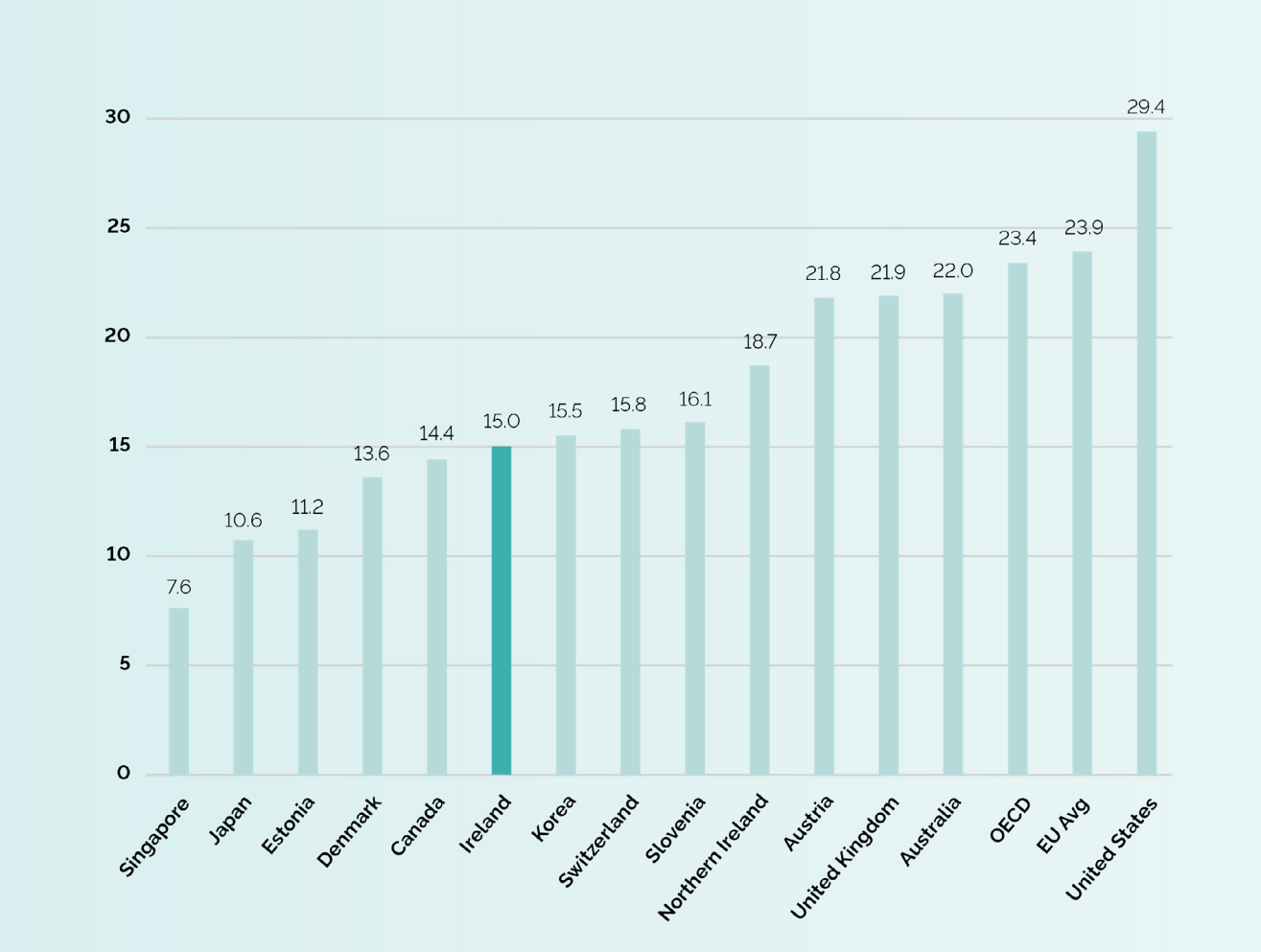


Figure 3. Percentages of students performing below Proficiency Level 2 in PISA 2015 (Shiel, Kelleher, McKeown, & Denner, 2016)

six levels, and to be at or below Level 1 means that participants can carry out basic arithmetic operations and procedures, along with identifying common graphical representations (OECD, 2013b). This result compares unfavourably with the OECD average, where 20% of adults are at or below Level 1. At the higher end of the numeracy proficiency scale, only 36.3% of adults in Ireland are at Levels 3, 4 and 5, in comparison to the OECD average of 46.8% of adults at these levels.

The overall levels of numeracy proficiency of adults in Ireland are lower than the overall levels of literacy proficiency. This is not surprising as the OECD (2013a) results of PIAAC found that, in general, there are a greater number of participants at lower levels of numeracy than literacy (Central Statistics Office [CSO], 2013).

The second cycle of PIAAC is taking place from 2018 to 2023 with the participation of over 30 countries/ economies. Data collection will take place in 2021–2022 and the results will be published in 2023.

Programme for International Student Assessment

The Programme for International Student Assessment (PISA) is an OECD initiative that began in 2000 and is conducted every three years in numerous countries, including Ireland. The objective of the survey is to assess the preparedness of 15-year-old students to meet the challenges they may encounter after they complete compulsory education. While PIAAC assesses numeracy capabilities of adults, PISA assesses the mathematical literacy, reading literacy, and scientific literacy of 15-year-old students. The PISA results for 2015 showed that students in Ireland achieved a mean score of 503.7 on the overall mathematical literacy scale, which is significantly above the corresponding OECD average of 490.2. Ireland's performance ranked 13th out of 35 OECD countries for PISA (2015) in mathematical proficiency; however, the reading literacy performance of students ranked 4th out of 34 OECD countries.

Similar to PIAAC, PISA results can be described in terms of proficiency levels, ranging from Level 1 to Level 6. PISA 2015 reported that 15% of Irish students were performing below Level 2 which, although far from ideal, indicates a better performance when compared

with the OECD average of 23.4% (see Figure 3). Level 2 is considered the basic level of mathematical proficiency that is required to participate fully in society and further education (OECD, 2013b).

Comparison between PIAAC and PISA

PISA and PIAAC assess similar skills and knowledge, in particular reading literacy and numeracy (or mathematical literacy). In both, skills are assessed on a six-level proficiency scale. It would be interesting to compare the results from the two surveys due to the similarities between the items. However, despite these similarities, there are significant differences between the surveys, in particular their target audiences and the ways in which the surveys are administered (CSO, 2013). Indeed, the PIAAC international report (OECD, 2013a) notes the difficulty in comparing results from the surveys. The OECD (2013b) advises that "it is not possible to identify with any accuracy where a 15-year-old with a particular reading literacy or mathematics score in PISA would be located on the literacy or numeracy scales of the Survey of Adult Skills" (p. 91). As a result, caution is advised when comparing results of PIAAC and PISA and drawing conclusions with respect to trends that may not be accurate.

Performance of adult learners in further education and training in Ireland

In an effort to improve adults' numeracy capabilities, Ireland's National Adult Literacy Agency (NALA) has a major role to play in advocacy and lobbying, policy making, research, development of teaching materials, and provision of distance education services. NALA also offers training to practitioners who are required to teach numeracy in the Further Education and Training sector. These training provisions have been welcomed by the tutors of numeracy and every year the feedback from these training days is positive (NALA, 2017). Amongst the many NALA initiatives of relevance to numeracy is the development of guidelines for integrating literacy and numeracy with vocational and other further education and training courses (NALA, 2013b).

A key element of the FET adult literacy and numeracy strategy (SOLAS, 2014) involves "conducting robust research into the practice and impact of integrating literacy and numeracy into all FET programmes" (p. 101). To support the ambition of this strategy, SOLAS (2018b) commissioned ICF Consulting Services to investigate the delivery of integrated literacy and numeracy in further education and training. In general, the practical application of literacy and numeracy in the Further Education and Training sector has been welcomed in Ireland. It was noted by the students of FET that even where the literacy and numeracy skills may not have been particularly relevant to their coursework, they did appreciate the importance of embedding literacy and numeracy in their courses as they recognised they might be used in the future:

> *Some reported that being able to write a letter, for example, was important for applying for jobs. Others stated that they believed the learning would help them use IT and communicate to friends through Skype and social media. These benefits motivated learners to attend literacy and numeracy courses. (SOLAS, 2018b, p. 32)*

The FET sector reported that delivering literacy and numeracy skills as part of the programme improved overall learner achievement (SOLAS, 2018b). Practitioners delivering the courses reported that it helped improve the quality of written assignments. One tutor from this study reported that the learners who engaged in literacy and numeracy support at times gained higher results in assignments than the learners who did not engage with this support. It was also reported that integration of literacy and numeracy was particularly valuable to learners undertaking apprenticeships at Level 6. Many of these adult learners had more practically-orientated skills and they felt challenged by the literacy and numeracy components in the courses.

Overall, this study concluded that integrated literacy and numeracy provision was a success as it ensured that this provision was embedded in the FET programmes, which in turn supported the learners to complete these programmes. However, it must be noted that there were some inconsistencies in practice, in that not all providers were in a position to measure the extent to which learners' literacy and numeracy skills improved after receiving support. That being said, there was ongoing assessment for learning and also, in the case of at least one ETB, a structured approach to pre- and post-testing of the relevant skills of the learners undertaking tuition with integrated approaches. Such pre- and post-testing has since become more commonplace with the formal recognition by the FET sector of the Support of Apprentices Group (SAG).

Consequences of Unmet Numeracy Needs

Numeracy and employment

Numeracy as a technical skill is essential for individuals in gaining employment and also for a nation's economic productivity and well-being. Research has shown that adults with higher competence in literacy, numeracy and problem solving tend to have better employment outcomes than their less proficient peers (Tout et al., 2017). Several studies have also demonstrated strong links between numeracy skills, employment and earnings. For example, Parsons and Bynner (1997) found that "only one in eight jobs [do] not require any numeracy skills at all and only one in four [have] minimal numeracy requirements" (p. 43). In a later study, Hoyles et al. (2002) found that the demand for mathematically literate employees was growing further internationally. According to an Institute of Directors report (2007), 98%

Figure 4. Percentage of men and women with varying levels of competency in numeracy and literacy who reported being depressed on the Malaise scale (Parsons & Bynner, 2005, p. 30)

of 500 UK employers surveyed selected numeracy as a key technical skill for employment from a list of 28 possible skills. As a result, numeracy was ranked as the sixth most important skill that employees should possess. This point was reiterated in the work of Durrani and Tariq (2012), who claimed that numeracy skills are recognised by the large majority of employers in the UK as essential for employability.

Given the importance employers attribute to numeracy skills in the workforce, the fact that many adults have low levels of numeracy undoubtedly impacts on their employability. The need for proficiency in numeracy among the workforce has led to a large number of employers using numeracy tests as part of their recruitment policy (Durrani & Tariq, 2012). Hence, low levels of numeracy skills can actually prevent adults obtaining a job of their choosing. Consequently, Carpentieri et al. (2010) found that men and women who demonstrated low levels of numeracy in the UK were twice as likely to be unemployed as people who demonstrated proficiency in numeracy. Furthermore, their study found that those with low numeracy skills were less likely to be promoted or receive a pay rise compared with people who possess good numeracy skills.

Similar findings to those discussed by Carpentieri et al. (2010) were reported in a large-scale longitudinal study conducted by Parsons and Bynner (2005). They found that men with poor numeracy spent 86% of their time in full-time employment compared with 95% of men who were competent in numeracy. A similar scenario emerged for females, with those with poor numeracy spending 53% of their time in full-time employment compared with 65% of females proficient in numeracy.

Not only do low levels of numeracy proficiency prevent adults from obtaining employment, but an individual's level of numeracy skill can also have an impact on the type of job that they are able to secure. A study by Shomos (2010), conducted in Australia, found that the majority of people with high levels of numeracy were employed as "professionals, managers and clerical and administrative workers", while those with low numeracy levels are predominantly employed as "labourers and technicians/tradeworkers" (p. 31). A similar finding was reported by Parsons and Bynner (2005). This relationship between job type and numeracy means that there is also a connection between numeracy levels and income. According to Parsons and Bynner, low levels of numeracy are associated with low income. In their study, they found that men with low levels of numeracy earned an hourly wage that was close to the lower end of the scale for all workers. Furthermore, Shomos and Forbes (2014) found an increase in literacy and numeracy by one skill level on the PIAAC scale, is associated with a 10 per cent increase in income and is associated with an increased likelihood of employment by 2.4 percent for men and 4.3 percent for women.

In summary, the research literature shows a strong positive relationship between numeracy and employability. Consequences of this relationship include a connection between numeracy levels and both job type and income, with those competent in numeracy having more job prospects available to them and the potential to earn more money in their career.

Numeracy and health

Research has pointed to correlational links between numeracy and personal health. Clearly, there are multiple factors that impact on personal health with levels of numeracy skill being just one. In the UK, Carpentieri et al. (2010) found that people with low numeracy levels are two and a half times more likely to develop a long-standing medical illness or disability than those who were proficient in numeracy. A similar finding also emerged in the work of Parsons and Bynner (2005). They stated that women who demonstrated low levels of numeracy along with adequate levels of literacy were "more likely than others to report poor physical health" (p. 33). In Ireland, NALA has been at the forefront of health literacy initiatives, working to make health literacy a priority for public policy (O'Connor, 2012). NALA's research highlighted the challenges faced by adults with weak literacy skills in understanding and processing health information. NALA has also pointed to international research that connects social deprivation with low levels of health literacy and lower levels of health. They argue that low levels of health literacy reduces a person's ability to read health information and understand instructions, leading to problems with making sound health decisions.

In the literature, relationships have been discovered between a person's level of numeracy and management of diabetes (Cavanaugh et al., 2008); history of hospitalisation with asthma (Ancker & Kaufman, 2007); and understanding of the risks associated with certain cancers (Brown et al., 2011). Furthermore, Ancker and Kaufman (2007) found people with low levels of statistical literacy, a key component of numeracy, "may be vulnerable to anti-scientific messages such as exaggerated warning about vaccine risks" (p. 716). One possible reason for this relationship between numeracy proficiency and health is that a plethora of information relating to health and/or preventive behaviours is presented in quantitative form, such as nutrition information, disease risks and so on (Ancker & Kaufman, 2007; Lipkus & Peters, 2009). Hence, low levels of numeracy may result in adults having difficulties in interpreting and understanding such information, which in turn could influence their ability to manage their personal health and medical decision-making. Garcia-Retamero, Andrade, Sharit, and Ruiz (2015) found that less numerate patients tended to shy away from making personal medical decisions, preferring instead to delegate such decision-making to others. This was not the case among patients who had high levels of numeracy.

In addition to poorer physical health, research has pointed to a relationship between numeracy and mental health. Garcia-Retamero et al. (2015) conducted a study with 502 men in Florida and found a significant association between their self-reported levels of numeracy and mental health issues. Those who perceived their numeracy skills to be low were more likely to report being unhappy and depressed. A similar finding was reported in the UK by Carpentieri et al. (2010). They found that both men and women in their study who demonstrated low levels of numeracy were approximately twice as likely to suffer with mental health issues such as depression when compared with people with high levels of numeracy. Parsons and Bynner (2005) found that numeracy was a better predictor of mental health than literacy, particularly among male subjects. In their study, participants were required to complete the Malaise scale, a research instrument which can identify someone with symptoms of depression, and subjects' scores on this scale were then compared with their level of proficiency in numeracy. The findings of this study are presented in Figure 4 (Parsons & Bynner, 2005, p. 30). Figure 4 shows that there are notable differences in the prevalence of symptoms of depression across the skill groups, with levels of numeracy acting as a strong predictor of depression among male subjects.

There are many factors in addition to numeracy that are implicated in a person's health status, and none of the studies reported here made any causal links between low numeracy levels and poor health. Nevertheless, this research does suggest that numeracy interventions could look for evidence of improvements in participants' well-being as well as in their specific numeracy skills.

Numeracy and educational attainment

In addition to health and employability, strong links have also been established between numeracy and educational attainment. It is not surprising that PIAAC participants who have completed Master's degrees or higher qualifications have a higher mean score than those participants who finished their education in lower secondary school (OECD, 2013a). The results of PIAAC (2012) for Ireland showed that 62.1% of participants who scored at or below Level 1 had completed primary level education only, in comparison to 21.8% of adults who scored at or below Level 1 whose highest level of education was upper secondary education.

In the UK, Parsons and Bynner (1997) found that 90% of males and 70% of females with low levels of numeracy and literacy had received no education beyond the age of 16. By comparison, only 55% of males and 40% of females displaying competent levels of numeracy and literacy had left school by age 16. Carpentieri et al. (2010) also presented the following statistics to further emphasise the link between numeracy and educational attainment/qualifications:

- People with poor numeracy were twice as likely to have left school by the age of 16 as those with good numeracy skills;
- People with poor numeracy skills were five times more likely to achieve no qualifications by the age of 34 than those with good numeracy skills;
- 5% of males and 8% of females with poor numeracy skills (Level 2 or below) obtained a

degree, or its National Vocational Qualification equivalent, by the age of 34, while the corresponding proportions for those with competent or good numeracy skills (Level 3 or above) was significantly higher.

Similar findings were echoed in the work of Chiswick, Lee, and Miller (2003). They ascertained that proficiency in numeracy and literacy can facilitate higher educational achievement, meaning that there is a stronger probability that those with good numeracy skills will advance to higher education and obtain more qualifications. This could help to explain the link between numeracy and employability, as Chiswick et al. also found a strong positive relationship exists between educational attainment and employment rates.

Intergenerational effects of unmet numeracy needs

Low levels of numeracy among adults have far-reaching consequences and often the impact is felt by people other than those displaying low competency levels. Issues surrounding the intergenerational effects of numeracy have been reported in a number of research studies. In Ireland, adult literacy and numeracy provision has long acknowledged the importance of strengthening family literacy as a means of overcoming intergenerational cycles of inequality and disadvantage (NALA, 2019; SOLAS, 2014).

In the UK, Carpentieri et al. (2013) found a strong relationship between parents' numeracy levels and those of their children. De Coulon, Meschi, and Vignoles (2011) also found that low levels of numeracy and literacy among adults impacted not only on their children's numeracy competencies but also on children's ability to perform well in cognitive and non-cognitive assessments. According to Carpentieri et al. (2013), while other factors such as parental qualifications and parental profession were somewhat associated with the numeracy skills of their children, none of these factors were considered as strong a predictor as parental numeracy skills. Although this intergenerational effect is a cause for concern, researchers have offered some hope for the future. Paterson, Stringer, and Vernon (2010) argued that "improving skills in adulthood has a positive effect on children's skills too, which may help to break the inter-generational challenge of poor skills being passed from one generation to the next" (p. 27). As a result, improving adults' numeracy skills could lead to improved numeracy capabilities among their children, thus helping to break the intergenerational cycle of low levels of numeracy performance.

Income and quality of employment

Numeracy as a technical skill is essential for individuals in gaining employment and also for a nation's economic productivity and well-being. Research has shown that adults with higher competence in literacy, numeracy and problem-solving tend to have better employment outcomes than their less proficient peers (Tout et al., 2017). Several studies have also demonstrated strong links between numeracy skills, employment and earnings. For example, Parsons and Bynner (1997) found that "only one in eight jobs [do] not require any numeracy skills at all and only one in four [have] minimal numeracy requirements" (p. 43). In a later study, Hoyles et al. (2002) found that the demand for mathematically literate employees was growing further internationally.

According to an Institute of Directors report (2007), 98% of 500 UK employers surveyed selected numeracy as a key technical skill for employment from a list of 28 possible skills. As a result, numeracy was ranked as the sixth most important skill that employees should possess. This point was reiterated in the work of Durrani and Tariq (2012), who claimed that numeracy skills are recognised by the large majority of employers in the UK as essential for employability. Equally, the HEA Irish National Employer Survey 2018 cited numeracy amonst other qualities as a desirable workplace attribute with, "...at least 80% of employers... satisfied with both HE and FET graduates in terms of; application of technical knowledge; computer and technical literacy; verbal and written communication skills; numeracy, processing and data interpretation skills; ability to work effectively, both on their own or with others; and attention to detail".[5]

An individual's level of numeracy skill can also have an impact on the type of job that they are able to secure. A study by Shomos (2010), conducted in Australia, found that the majority of people with high levels of numeracy were employed as "professionals, managers and clerical and administrative workers", while those with low numeracy levels are predominantly employed as "labourers and technicians/tradeworkers" (p. 31). A similar finding was reported by Parsons and Bynner (2005). This relationship between job type and numeracy means that there is also a connection between numeracy levels and income. According to Parsons and Bynner, low levels of numeracy are associated with low income. In their study, they found that men with low levels of numeracy earned an hourly wage that was close to the lower end of the scale for all workers. Furthermore, Shomos and Forbes (2014) found that if a person were to improve their literacy and numeracy skills by one level on the PIAAC scale, this would result in a corresponding 10% increase in their income.

Given the importance employers attribute to numeracy skills in the workforce, the fact that many adults have low levels of numeracy undoubtedly impacts on their employability. The need for proficiency in numeracy among the workforce has led to a large number of employers using numeracy tests as part of their recruitment policy (Durrani & Tariq, 2012). Hence, low

5 Higher Education Authority Irish National Employer Survey 2018, p3-4.

levels of numeracy skills can actually prevent adults obtaining a job of their choosing.

Risk of unemployment

Carpentieri et al. (2010) found that men and women who demonstrated low levels of numeracy in the UK were twice as likely to be unemployed as people who demonstrated proficiency in numeracy. Furthermore, their study found that those with low numeracy skills were less likely to be promoted or receive a pay rise compared with people who possess good numeracy skills.

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In summary, the research literature shows a strong positive relationship between numeracy and employability. Consequences of this relationship include a connection between numeracy levels and both job type and income, with those competent in numeracy having more job prospects available to them and the potential to earn more money in their career.

Challenges in Adult Numeracy

Distinguishing between literacy and numeracy

As discussed previously, the term *numeracy* was initially derived to mirror the term *literacy* (Ministry of Education, 1959). O'Donoghue (2002) claims that this has resulted in numeracy and literacy, across all stages of the lifespan, being bracketed together when they are discussed in the public domain. According to Perso (2006), the bracketing of these distinct constructs has resulted in members of the public, as well as those involved in education, believing that literacy and numeracy are inextricably linked. This lack of distinction between numeracy and literacy is evident worldwide and in recent policy documents in Ireland. For example, the National Strategy for Literacy and Numeracy, published by the Department of Education and Skills (2011), outlines its intention to improve the teaching and learning of both numeracy and literacy simultaneously.

The close ties between these two terms has led to some problems in relation to numeracy education, and in particular adult numeracy education. For example, according to Westwood (2008), it has resulted in numeracy being subsumed by literacy. This in effect means (as noted by Donoghue, 2000) that literacy and numeracy have been traditionally bundled together and this, in turn, can have an impact on funding and policy. In administrations where there has been a longer history of greater research into literacy, numeracy may not have received the same level of attention and therefore may lack a sufficiently robust evidence base with which to influence policy and allocation of resources. Carpentieri et al. (2010) echoed this sentiment when they stated that in the UK, "in the field of adult education, literacy has consistently taken prominence over numeracy" (p. 9). Furthermore, Parsons and Bynner (2005) acknowledge that people worldwide recognise the importance of literacy skills but they contend that numeracy skills continue to be undervalued and underappreciated. However, their longitudinal study of over 17,000 subjects indicated that low levels of numeracy had more negative repercussions than low levels of literacy, particularly among women. As a result of their study, they claim that numeracy may matter more than literacy in terms of life chances. Due to the ramifications of unmet numeracy needs for the life outcomes of adults by the age of 30, which Parsons and Bynner found to outweigh those associated with literacy, they call for policy to address adults' numeracy needs and for interventions to target low levels of numeracy skills, particularly among the most disadvantaged in society. They argue that building numeracy capacity in this way can help alleviate issues associated with social exclusion, particularly among females. Similarly, Carpentieri et al. (2010) state that in order for economic growth to continue in the UK, more emphasis needs to be placed on improving the numeracy skills of the workforce. These arguments are consistent with the prioritisation of numeracy by Ireland's FET sector (SOLAS, 2014).

Distinguishing between mathematics and numeracy

This report began by discussing some of the challenges in defining numeracy, and in understanding the subtle differences between *numeracy*, *mathematical literacy*, and *quantitative literacy*. However, the relationship between *mathematics* and numeracy is also poorly conceptualised. A common misconception in society is that numeracy and mathematics are the same subject, just with a different name (Quantitative Literacy Design Team, 2001). Some researchers describe the difference between mathematics and numeracy as "difficult to capture in words" (Goos et al., 2019, p. 18). Although it is agreed that mathematics is used in the development of numeracy, it cannot be said that numeracy relies solely on mathematics. Numeracy is not defined exclusively by the content of mathematics but instead is concerned with enabling people to use and apply mathematical knowledge effectively to meet the general demands of everyday life (Department of Employment, Education, Training and Youth Affairs [DEETYA], 1997). Mathematics is the study of abstract patterns and structures, while numeracy is concerned with contexts in which a person will use mathematical knowledge in everyday life. The Quantitative Literacy Design Team (2001) describes the difference in terms of mathematical progression as "climbing the ladder of abstraction", while working

in a variety of contexts is instead the goal of numeracy (Goos et al., 2019).

Difficulties in distinguishing between mathematics and numeracy are evident in the Irish literacy and numeracy strategy, in which there is an emphasis on "promoting mathematics" (DES, 2011). Similar overlaps occur in Ireland's Skills Strategy 2025, with the document referring to "mathematics" when describing numeracy goals (DES, 2016). These policies aim to improve numeracy standards but reference mathematics throughout, which causes confusion in understanding and operationalising the difference between numeracy and mathematics.

While mathematics and numeracy are interlinked, there are important differences in how they might be taught and the opportunities to learn experienced by students. Mathematics is taught as a separate subject in the school curriculum due to its disciplinary nature and status. In contrast, many researchers call for numeracy to be taught across the school curriculum and not as a separate subject (Goos et al., 2019). Thus numeracy can be developed as a consequence of learning all subjects across the curriculum, and not only mathematics. Looking beyond school towards adult life, Noss, Hoyles, and Pozzi (2000) claim that the mathematics used in workplaces is either "invisible to the user" (p. 28) or used in a different way from how it is taught in school. This may be why the mathematical knowledge used in work and everyday lives is often described by adults as "common sense" or just "part of the job" (Keogh et al., 2018, p. 5). Yet, after many years of learning mathematics in school, students and adults still struggle to use mathematical knowledge to meet the demands of everyday life. This observation suggests that some important numeracy skills needed in adult life have been overlooked in the teaching of mathematics in school (O'Donoghue, 2002).

The affective domain

The affective domain and how emotions and learning are interlinked have long been recognised as an important aspect of mathematics teaching and learning (Dowker, Cheriton, Horton, & Mark, 2019; Fennema & Sherman, 1976; McLeod, 1992). In this sense, adult numeracy is no different. Indeed, Carpentieri et al. (2010) determine that adult numeracy learners have often had particularly poor experiences of education, and thus the influence of the affective domain may be even more pronounced for this cohort. While the domain encompasses a wide range of foci, such as one's attitudes, beliefs, and values, the most dominant aspect of affect in terms of adult numeracy research over the past thirty years has been "mathematics anxiety".

Mathematics anxiety has been defined by Richardson and Suinn (1972) as "feelings of tension … that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 571). While Martinez and Martinez (1996) determine it to be a construct with multiple causes, many link its origins to negative classroom experiences from the past. Such experiences may include the use of traditional teaching methodologies, where mathematics involves the memorisation of formulas, and the following of rules and procedures (Idris, 2006; Prendergast et al., 2014). Harper and Daane (1998) went further and proposed the causes for mathematics anxiety as rigid class applications, with examinations and grades being continuously emphasised by teachers. Furthermore, Bibby (2002) suggests there is a connection between traditional mathematics classrooms and shame, where mathematical tasks are often seen as right or wrong and students are open to scrutiny and judgement, particularly if not "correct".

A theme that often emerges from research on adults' difficulty in learning mathematics is the point at which the subject stopped making sense and moved from the concrete to the abstract (Coben et al., 2003). For many adults, this abstraction triggered negative feelings, a lack of relevance to their own lives, and a dearth of confidence in their own ability (Carpentieri et al., 2010). However, while there is no doubting the impact that this may have, in some cases negative perceptions of mathematics and numeracy have become accepted in popular culture. This is best summed up by Ernest (1995), who noted that "in contrast to the shame associated with illiteracy, innumeracy is almost a matter of pride" (p. 449) amongst some people. This has led to people underestimating their use of mathematics in daily life or dismissing the mathematics they can do as common sense or anything but mathematics (Coben et al., 2003). For example, Keogh et al. (2018) found that it is common for people to declare themselves "not a maths person" while behaving in numerate ways.

Notwithstanding the causes, mathematics anxiety and negative perceptions have had a damning effect on the mathematics education experiences of many learners over the past forty years. In a UK study carried out for the 1982 Cockcroft inquiry into mathematics, Sewell (1981) reported that at least half of the adult population, including many with excellent mathematical qualifications, had negative feelings about the subject. These included a lack of confidence, anxiety and fear. More recently, Carpenteiri et al. (2010) found that even highly qualified adults often suffered a lack of confidence in their mathematical ability. This is in line with an Irish study which found mathematics anxiety to be an issue amongst a cohort of pre-service secondary mathematics teachers who all had an undergraduate degree in the subject (Prendergast, Ní Ríordáin, Ní Shúilleabháin, Johnson, & O'Rourke, 2020). It would seem that a lack of maths confidence is not solely confined to the domain of FET tutors and the onus remains on practitioners to engage in continuous upskilling in this regard.

If negative classroom experiences from the past are the main causes of mathematics anxiety, it is important that teachers make a conscious effort to address such issues in their classrooms. Schorr and Goldin (2008) argue that

it is possible to facilitate changes in the affective domain given the right circumstances, which they describe as "emotionally safe environments" (p. 131).

School Experience and the Construction of Innumeracy – An Overview of Teaching, Learning and Assessment

The teaching and learning of numeracy

The importance of effective teaching at all levels of the education system, from early childhood to adulthood, is recognised throughout the literature. It is distinguished as the backbone of any successful education system (Prendergast & O'Donoghue, 2014) and is regarded as the single biggest contributor to student success (Wenglinsky, 2000). However, despite such importance, the concept of defining an effective teacher is a problematic one. Papanastasiou (1999) stated "that no single teacher attribute or characteristic is adequate to define an effective teacher" (p. 6). This view is derived from the fact that the instructional criteria differ for every situation and for every teacher. Each teacher also brings their own experiences, skills, knowledge, and personality into the classroom. Furthermore, good teachers make teaching look effortless and this makes the nature of their underlying knowledge and skill hard to pin down (Fox, 2005).

With this in mind, Carpenteriri et al. (2010) determined that in numeracy teaching it is sometimes easier to quantify "bad practice" than to define "good practice". According to Swain (2005), "bad" practice involves the teacher using a series of procedures, where the students learn by rote and without understanding. No connections are made to other areas of numeracy and there is little talk or discussion between learners. On the other hand, Swain and Swan (2007) contend that "good practice" focuses on developing students' conceptual understanding through collaboration and the exploration of mathematical ideas. It provides learners with the opportunity to make connections from one area of numeracy to another, and to bring their own methods to the learning process (Swain & Swan, 2007). In Australia, some progress towards specifying what good numeracy teaching practice looks like is evident in the publication of numeracy standards for graduating teachers (Board of Teacher Registration, Queensland, 2005). The standards were developed for both teachers of mathematics (including primary school teachers and specialist secondary school mathematics teachers) and teachers of subjects other than mathematics. For both these groups, the standards address three domains:

Professional knowledge: incorporating knowledge of students and their numeracy learning needs, knowledge of numeracy appropriate to the year levels and subjects they teach, and knowledge of how to support students' numeracy learning.

Professional attributes: incorporating personal attributes such as high expectations for students' numeracy development, a commitment to personal professional development in order to enhance personal numeracy knowledge and teaching strategies, and acceptance of community responsibilities in communicating informed views about numeracy.

Professional practice: incorporating establishment of supportive and challenging numeracy learning environments, planning for numeracy learning in all curriculum areas, demonstrating effective numeracy teaching strategies, and using assessment strategies that allow all students to demonstrate their numeracy knowledge.

While these professional standards refer to the work of school teachers, there is potential for their adaptation to the adult numeracy context. The need for such guidance is suggested by National Research and Development Centre (NRDC) research on effective teaching and learning in the UK (Coben et al., 2007), which showed that the dominant mode of teaching numeracy to adults remains one in which teachers show procedures, break concepts down into smaller parts, and demonstrate examples. Factual recall-type questions are common (Carpenteiri et al., 2010), and there is little collaborative work or use of practical resources such as information and communications technologies (ICT) (Swain & Swan, 2007).

The place of ICT

The place of ICT in mathematics and numeracy teaching and learning has been an issue of debate in recent years. It has been found that digital tools can pave the way for inquiry-based, collaborative, realistic mathematics learning (Bray & Tangney, 2017). Traditional "talk and chalk" and "paper and pen" methods of teaching mathematics are being replaced by innovative, practical methods, many of which are supplemented by a digitalised, interactive approach (Parmar & Rathod, 2014). With specific reference to numeracy, Goos et al. (2014) argue that the effective integration of digital tools into classroom teaching can support and enhance students' capabilities. They give instances such as the collection, recording, and analysis of real-world data and comparing the features of relevant data sets; critiquing a situation or making judgements. For example, the flexibility and capacity of software programmes such as Microsoft Excel enables teachers and students alike to be involved in meaningful mathematics activities such as analysing, organising, and exploring data. Another study by Mellar, Kambouri, Sanderson, and Pavlou (2004) noted the ability of ICT to display number concepts visually and to have immediate feedback as the main advantages of ICT in teaching numeracy.

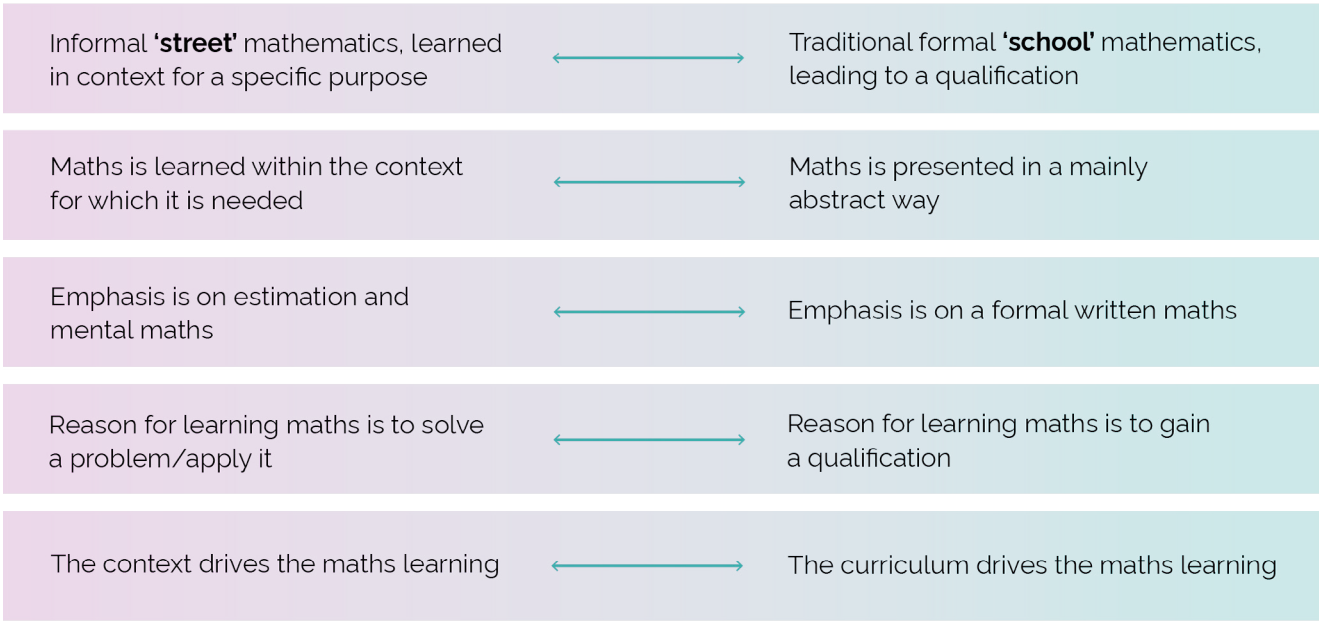


Figure 5. Different approaches to teaching and learning mathematics and numeracy (Brooks, 2013, p. 142)

Furthermore, in Bray and Tangney's (2017) study, students reported enjoying the technological approach for the independence and variety it provided, as well as the manner in which they were pushed to solve problems.

However, despite the potential for teaching and learning to be transformed by the availability of digital technologies such as computers, calculators, and the Internet, research in many countries has found that technology still plays a marginal role in mathematics classrooms (Bennison & Goos, 2010). While students undoubtedly engage in the creative use of digital technologies on a daily basis, they do so less frequently in an educational context (Oldknow, 2009). In many educational settings, technology is still frequently used as it was in the 1990s, simply to convey information to students (Conole, 2008) and to "transfer the traditional curriculum from print to computer screen" (Kaput, 1992, p. 516). In order to explain this phenomenon, Knezek et al. (2000) found several barriers to the integration of technology in classrooms. These included cost, access, and logistical problems. There are also issues centred on the constraints of curriculum and assessment and the structures imposed by the infrastructure of the educational organisation (Oates, 2011; Olive et al., 2010). However, while all of these factors play a role in discouraging greater use, it is teachers' lack of skill and confidence and their uncertainty about the benefits of technology for students' mathematics learning that may be most significant (Olive et al., 2010). Means (2010) points out that many teachers will only expend the effort required to integrate technology into their teaching practice when they can see that there are significant benefits in terms of learning outcomes.

It is clear that digital technologies are transforming the workplace, taking over many tasks that were previously done in the head or with pencil and paper. Jorgensen Zevenbergen (2011) has studied the numeracy practices of young workers in a range of jobs, particularly in relation to their uses of digital technologies. She found that young people are often found wanting for seeming to lack the numeracy skills valued by older workers, such as being able to carry out accurate mental or written calculations. She proposed that these older practices might not be so relevant to the modern world, in which there is easy access to digital tools such as calculators, spreadsheets, and the Internet. For example, in some of her research case studies she observed how young people working in retail used problem-solving strategies that deferred the cognitive labour to technology when undertaking routine tasks. However, their older supervisors were surprised by this approach and they continued to value more traditional ways of working. In particular, older workers placed much emphasis on accurate calculation done by hand or in the head, while young workers regarded calculation as a menial task that is better left to technology. As a consequence, young workers seemed to develop a stronger orientation towards problem solving and estimation.

Since PIAAC assesses adult numeracy in the domain of problem solving within technology-rich environments, there is a need for further research into how the digital strategies employed by some learners may be used to meet the challenges faced by those who struggle with technology in their learning environments.

Teaching numeracy using a subject-specific or cross-curricular approach

Within many educational jurisdictions, the learning and teaching of numeracy is expected to take place within traditional mathematics classes. However, this raises difficulties with regard to the differences between mathematics and numeracy which were discussed previously. While mathematics has often been traditionally taught with a focus on rules and

Cumming and Gal (2000)	Good Practice Guidelines in Initial and Ongoing Assessment of Literacy and Numeracy
1. Both instruction and assessment of adult numeracy skills should be informed by broad definitions of numeracy to encompass the work and life mathematical experiences and strategies adults already have.	"Literacy", "numeracy", and "assessment" are complex concepts that can be understood in different ways by different people, depending on the situation and the purpose. Numeracy is the ability to access, use, interpret, and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life.
2. Ideally, assessment should address reasoning processes and (mathematical) problem solving, conceptual knowledge and computation, and the ability to interpret and critically react to quantitative and statistical information embedded in print or media messages, as well as examine transfer of mathematical problem solving across life and work contexts.	Recording of assessment results refers to technical knowledge and skill *and also* to the relevant broader dimensions of application and competence.
3. Assessment should be directed by the instructional focus and goals of the programme, not vice versa.	Based on the individual's knowledge, skills, goals and aspirations; any dimension of literacy or numeracy the person needs in order to achieve their goal should be assessed.
4. One type of assessment alone (e.g., use of standardised tests) will not be sufficient to inform all assessment or evaluation requirements of learners or a programme.	Where possible, resources make use of authentic tasks, situations and materials.
5. Convenient and apparently simple assessments such as standardised tests may not be appropriate and informative and may do a disservice to students, teachers, and a programme.	
6. Adult numeracy assessment should encompass the range of assessment forms being used in other educational settings and may include oral reports, group activities, portfolios, and so forth.	Resources are selected to be consistent with the learner's goals and specific learning objectives.
7. Adult numeracy assessment should recognise that adult learners may perform at quite different levels in oral mathematical discussions from how they perform on written tasks.	Materials are aligned to literacy and numeracy Levels 1, 2, 3 on the NFQ/QQI framework. For more complex activities, sub-skills and specific dimensions may be at different levels.
8. Assessment indicators for workplace programmes are most appropriately drawn from a task analysis of work.	Initial and ongoing assessment of adult literacy and numeracy is carried out using the *performance task* method of assessment.
9. Assessment should inform students in a systematic way of their progress in, and achievement from, a programme.	The assessment process generates a profile, mark, level or grade, but not reading or spelling ages.
10. Only appropriate interpretation and use should be made of assessment information; adult numeracy practitioners need to be aware of cultural difficulties in planning and interpreting assessment (pp. 328–329).	Recording of assessment results refers to technical knowledge and skill *and also* to the relevant broader dimensions of application and competence. Recording of assessment results refers to specific learning goals which allow for ease of monitoring progress over time.

Table 2. Issues in Adult Numeracy Assessment: Relationship between Research and Good Practice Guidelines

procedures which are disconnected from everyday life (National Council for Curriculum and Assessment, 2005), this goes against the very grain of numeracy which aims to help students learn to use mathematical ideas and concepts in contexts away from the classroom (Geiger et al., 2015). Such a chasm highlights a debate between the terms "street" mathematics and "school" mathematics, which evolved from research studies by Nunes, Schliemann, and Carraher (1993), who aimed to identify the relationship between different types of formal and informal numeracy practice. The informal "street" mathematics describes mathematics learnt *in situ*, for example in the workplace or in other personal contexts. The research of Nunes et al. foreshadowed the social practice perspective on numeracy that values the numeracy practices embedded in people's daily lives. In particular, the ethnographic approach adopted by these researchers revealed that the situated numeracy practices undertaken by the participants were fundamentally different from mathematics as it is typically practised in the classroom. The main differences are best highlighted in Figure 5 (from Brooks, 2013).

Given such differences, many argue against the integration of mathematics and numeracy. For example, Lee (2009) proposed that constructs such as numeracy should be considered an "educational by-product … [that results from] … studying mathematics, physics, chemistry, biology, business studies and various other subjects in which numbers and mathematics concepts find application" (p. 218). On the other hand, the Quantitative Literacy Design Team (2001) argues that effective numeracy instruction must take place in all school subjects, not just mathematics. However, there are also many difficulties associated with such interdisciplinary approaches. For example, teachers of each subject must have the capacity to recognise when a numeracy opportunity arises and the knowledge and skill to take advantage of such an opportunity (Geiger et al., 2015). Furthermore, there may be some implications for the structuring of the curriculum in each subject in order to create a genuinely integrated approach to teaching and learning across the disciplines (Geiger et al., 2015). Thus, the issue of how to best to promote numeracy capabilities – as a subject-specific or an interdisciplinary approach – remains open to question, and further work in this area is needed.

Teaching, learning and the affective domain

Given the importance of the affective domain in adult numeracy, there is a promotion of "more relaxed" and "supportive" pedagogical approaches for adult learners (Coben et al., 2007). As discussed previously, these learners have often had negative experiences of school mathematics, and thus the learning environment they tend to prefer is noticeably different from the normal school experience (Carpertieri et al., 2010). With this in mind, teachers/tutors need to ensure a smooth and welcoming return to education for adult learners whose previous schooling experiences may have left them demotivated and closed off to learning (Swain & Swan, 2007). Ackland (2014) recommends a critical pedagogy is employed by tutors in which they bring less, not more, to the learning experience. Thus, instead of adding more activities, tutors are encouraged to incorporate a more social-practice approach and explore with learners the powerful uses of mathematics in society. This linking of mathematics to life or work contributes to a sense of social belonging and relatedness (Ryan & Deci, 2000), which can have a positive influence on the affective domain. A series of case studies carried out by NALA (2013c) also highlighted the use of problem-based learning activities and meaningful contexts. More specifically, they note that a context is the starting point for the learning (the source of what needs to be learned) and not the end application for a set of learned skills. Furthermore, in terms of the affective domain, it is central for the tutor to create a positive learning environment in which there is a relaxed atmosphere and people feel secure and are not afraid to make mistakes (Coben et al., 2007). In this kind of environment, there is less pressure from teachers and peers, and adults are more inclined to be stimulated by the content (Carpentieri et al., 2010).

Assessment of numeracy

It is worth pointing out that the sections above relating to PISA and PIAAC assessments refer to one-off, "snapshot in time" assessments that have as their aim the generation of quantitative results which facilitate the compilation of international league tables. Given the design and deployment of such assessments, it is not possible to gather as much contextual information as with other approaches to assessment. Understandably, there are some concerns about the competitive nature of these large-scale international testing programmes, the over-emphasis on the quantitative data generated, and the unsuitability of such tests for assessing numeracy – including adult numeracy – in authentic contexts. It is feared that such tests may lead to a disregard of the assessment of students' numeracy at a local level and the vital role of teachers in making judgements about their own students' numeracy capabilities (Geiger et al., 2015). For example, Cumming and Gal (2000) found that in Australia and the UK many adult numeracy teachers are resistant to standardised forms of assessment, even at a local level, because they will uncover only some of the valuable skills and knowledge a student may possess.

However, the results of programmes such as PISA and PIAAC are a key influence on educational policy within participating nations and have potential in providing direction for countries in how to improve their approaches to developing students' numeracy (Geiger et al., 2015). Given the influence of international assessment programmes such as PIAAC and PISA, it is valuable to develop approaches to assessment that are focused on assessment at all stages of the learning cycle and that are designed to recognise and capture valuable contextual information at all stages of learning.

Such approaches go beyond the generation of text items to a more holistic understanding the uses of certain types of assessment and the optimal stage in the learning process for their use. Recently published good practice guidelines on assessment of literacy and numeracy in Education and Training Boards (SOLAS, 2018a) provide a very useful way to both conceptualise and operationalise initial and on-going assessment of numeracy – both of which feed into and strengthen any summative assessment that might ensue.

Based on their research, Cumming and Gal (2000) draw out a number of implications for future assessment practice in adult numeracy. The good practice guidelines on initial and ongoing assessment of literacy and numeracy in ETBs (SOLAS, 2018a) provide principles and conditions of assessment. The parallels between the two approaches are outlined in Table 2.

Conclusion

This review of research into international and national policy and practice in adult numeracy endorses the critical importance of numeracy for productive citizenship, individual life chances, and the social and economic health of nations. Moreover, there is convincing evidence that numeracy matters more than literacy in enabling these outcomes. Yet much needs to be done to ensure that all people achieve a level of numeracy that supports full participation in life and work.

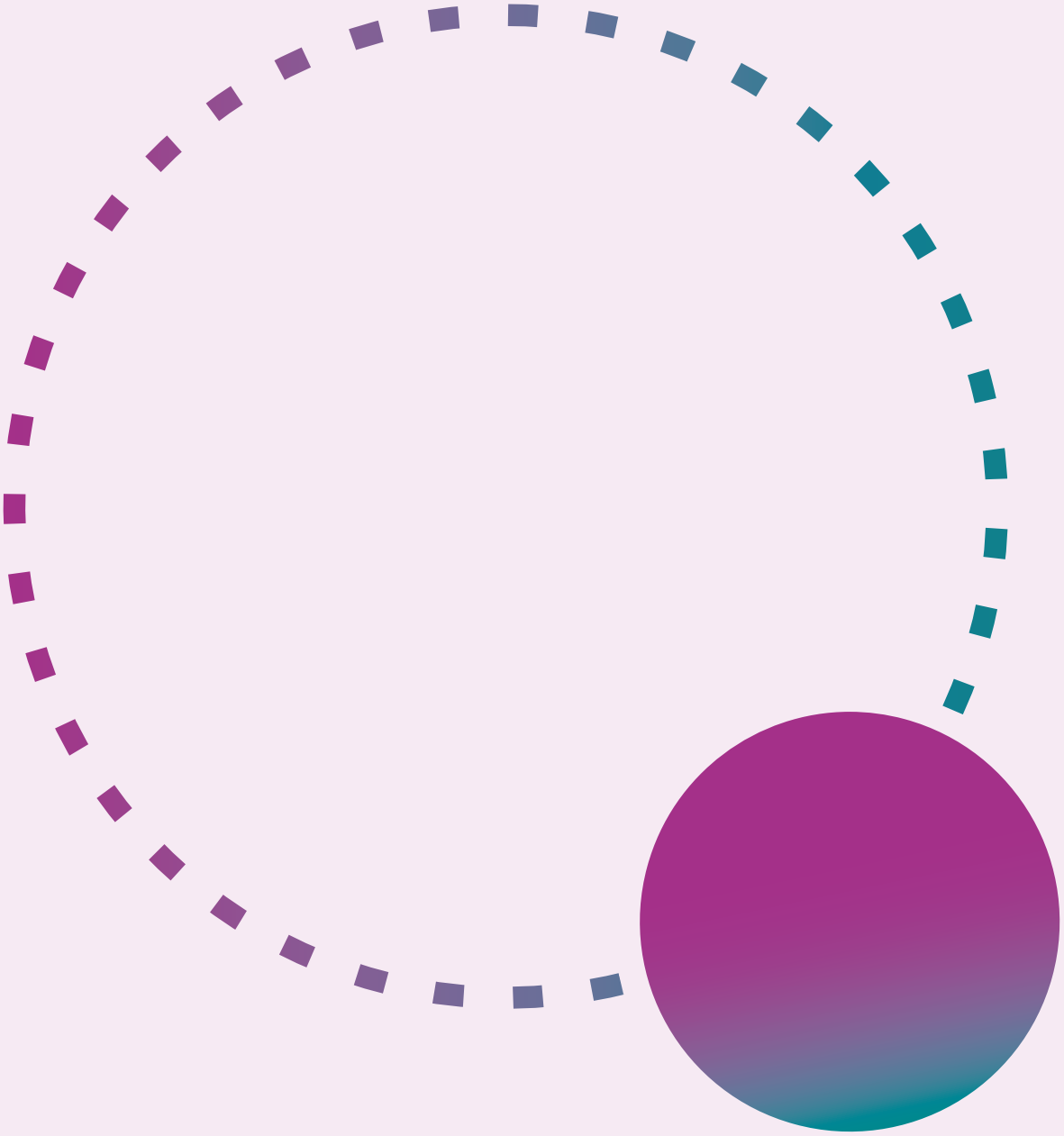
The first requirement involves developing a clear and sophisticated definition of adult numeracy that can properly and coherently inform policy and practice. The literature is fragmented and contradictory in this regard, with most studies implicitly adhering to a version of numeracy as a technical skill needed for economic development rather than a social practice embedded in home, work and community activities (Coben & Alkema, 2018). There are also differences between the ways in which numeracy is conceptualised within school and adult settings, with the former often more concerned with developing mathematical skills while the latter acknowledges the context-dependence of numeracy in real-life situations. These differences need to be explored and critiqued, with the aim of determining what numeracy means at different stages of a person's lifespan.

A second requirement involves addressing and dispelling notions that it is acceptable for a person to be bad at mathematics because mathematical ability is innate and not something that can be acquired through learning. Yet there is an interesting contradiction here, in that adults who had difficulties learning mathematics in a formal school environment feel tremendous anxiety, and even stigma, at their perceived deficit. Provision of adult numeracy support that aims to compensate for deficiency, rather than valuing the variety of numeracy practices embedded in adults' daily lives, only serves to exacerbate this negative self-assessment of ability.

A third requirement concerns teaching in schools. Although the subject of this review was adult numeracy, it is necessary also to turn our gaze to schools and their role in developing children's numeracy capabilities. Teachers of mathematics have an important role in providing the mathematical foundations of numeracy, but all teachers are responsible for ensuring that students have opportunities to apply their mathematical knowledge in the context of different subjects across the curriculum (Goos et al., 2019). Although Irish students perform well in the PISA assessment of mathematical literacy, PIAAC results indicate that a large proportion of Irish adults demonstrate the lowest levels of numeracy and that these adults are also likely to have only a primary school education. Schools have an important role in encouraging young people to persevere and succeed in their formal education well beyond the primary school years.

There is, in addition, much work to be done in relation to a fourth requirement, facilitating effective continuing professional development (CPD) for adult numeracy tutors who may be working in isolation in small centres and also those tutors who may not have a background in the area. CPD is also essential for bringing about the pedagogical transformation and educational culture change which is required for the effective implementation of innovative approaches (Bray & Tangney, 2017).

Finally, in arguing that adult numeracy is an under-researched and under-theorised field, this review shows that more research is needed not only to develop a better understanding of adult numeracy itself, but also to create a stronger and more rigorous foundation for practical adult numeracy interventions and for the professional development of adult numeracy tutors. It is particularly important to develop a stronger research base in the Irish context, since most of the existing literature in this field reports on studies conducted in the UK and other countries. In addition, further practical progress will require collaboration between researchers, practitioners and policy-makers in order to design, deliver, and evaluate effective research-informed programmes for improving adult numeracy in Ireland.



Chapter 2.
Survey Analysis

Methodology

An online survey was developed by NALA staff in order to establish the range and depth of adult numeracy activity in each ETB area. The surveys were completed by a designated officer in each ETB. Each ETB selected the person best positioned to access the information needed to complete the survey on behalf of their ETB as their designated officer. The 51 survey items were grouped into categories. The first (unnamed) group of items sought information on programme demand and budget. Subsequent categories were concerned with programme type and duration; recruitment and referrals; programme outcomes; assessment, accreditation and evaluation; participant groups, numbers and gender; partnerships; and staff and training. Items required either a short response or a selection from amongst provided response options. A copy of the survey is provided in Appendix 1.

The survey was administered online via SurveyMonkey. Responses were received from 15 ETBs and transferred to a spreadsheet for analysis.

Results

An analysis is presented of each of the answers to the 51-item survey.

Programme demand and budgets

Question 2 sought to gather information relating to the **total number of adult literacy learners** in individual ETBs. In total, fourteen ETBs offered a response and the number of adult literacy learners varied significantly across ETBs. The number of adult literacy learners ranged from 8,416 to 657 across the fourteen ETBs, with a median figure of 2,059. The total number of adult literacy learners, based on this survey, is 39,110.

Question 3 investigated the proportion of adult literacy learners who attended **standalone numeracy tuition.** Again, fourteen ETBs responded to this question and thirteen reported that less than 20% of adult literacy learners engaged in standalone numeracy tuition, while the remaining ETB reported that 60% of their adult learners engaged in this type of tuition. One ETB reported no adult learners engaged in standalone numeracy programmes.

Question 4 was phrased similarly to Question 3 but focused on the proportion of adult learners who attended **embedded or integrated numeracy tuition.** The reported proportions were somewhat higher than those offered in response to Question 3. Three ETBs reported that less than 10% of adult learners attended such courses, while the proportion in the remaining ten ETBs ranged from 15% to 100%. One ETB reported that a breakdown was not available as "numeracy is integrated as much as possible into all provision."

Having investigated the proportion of adult learners who attended numeracy programmes, **Question 5** then sought to determine how many **hours of adult numeracy** were available in a given week across the ETBs. In total, twelve ETBs responded to this question. The results are presented in Figure 6.

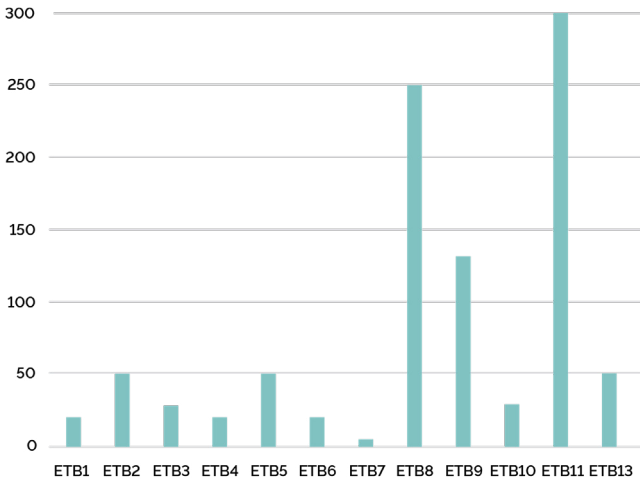


Figure 6. Hours allocated to adult numeracy on a weekly basis

The responses offered by the ETBs show a considerable spread in the number of hours spent on adult numeracy on a weekly basis across the ETBs. ETB11 and ETB8 allocated many more hours to numeracy activities on a weekly basis than other ETBs surveyed. ETB7, which reported allocating seven hours per week to numeracy activities, had significantly fewer hours than other ETBs surveyed.

Questions 6 and 7 investigated the **number of paid tutor hours** for adult numeracy and standalone adult numeracy, respectively, in 2018. Nine ETBs responded to Question 6 and 11 responded to Question 7.

	Mean	Median	Min	Max	Range
Adult Numeracy Courses	2919.25	1065.75	3	12,000	11,997
Standalone Adult Numeracy	871.81	891.00	0	2,000	2, 000

Table 3. Summary Statistics for Number of Paid Tutor Hours

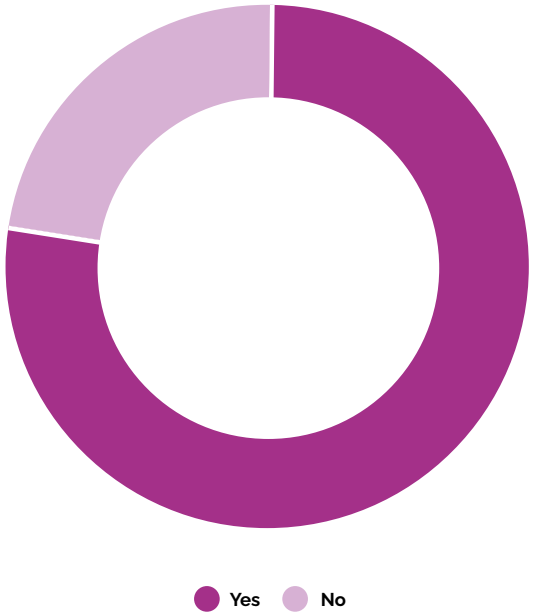


Figure 7. Does supply of numeracy courses meet demand?

Summary statistics for the data collected are presented in Table 3.

Question 8 prompted respondents to share the number of paid numeracy coordination hours in 2018. This information was not disclosed through the survey process.

Question 9 in the survey asked whether there was a **numeracy co-ordinator** for adult numeracy in each of the ETBs. All fourteen ETBs that responded to this question stated that no such person had been appointed.

Question 10 enquired whether the **supply of numeracy courses meets demands.** Fourteen ETBs offered a response to this dichotomous question. The results, presented in Figure 7, show that the majority of ETBs (n = 11) indicated that the provision of numeracy courses does meet demands.

Three ETBs said supply did not meet demand and **Question 11** explored what additional resources are needed in these three ETBs to facilitate more numeracy courses. All three ETBs offered a suggestion and these are outlined below:

> ***ETB1:*** *I think that we are meeting demand in that we offer numeracy and mathematics in all our centres up to L3. But the options are not always taken up, so not all courses that we plan will run. With more outreach to primary schools I think we could increase the number of parents doing numeracy. We provide family learning maths in 2 primary schools and expect to be in 2 more this term. I think a FL coordinator would be a useful resource to us, with implementing a numeracy strategy as one of the principle objectives of the job.*
>
> ***ETB4:*** *More expertise in areas such as Maths for Apprentices.*
>
> ***ETB10:*** *We integrate numeracy to make it relevant to everyday life and other modules being undertaken. Additional funding would facilitate the delivery of more courses at Levels 2 and 3 with integrated numeracy.*

Questions 12–14 investigated the number of **adult numeracy courses** that were held in each of the ETBs in 2018. **Question 12** required respondents to outline the number of numeracy courses run over the year; **Question 13** looked at the number of **standalone numeracy courses** that were run; while **Question 14** looked at the number of **integrated numeracy courses** offered. Twelve ETBs gave the number of adult

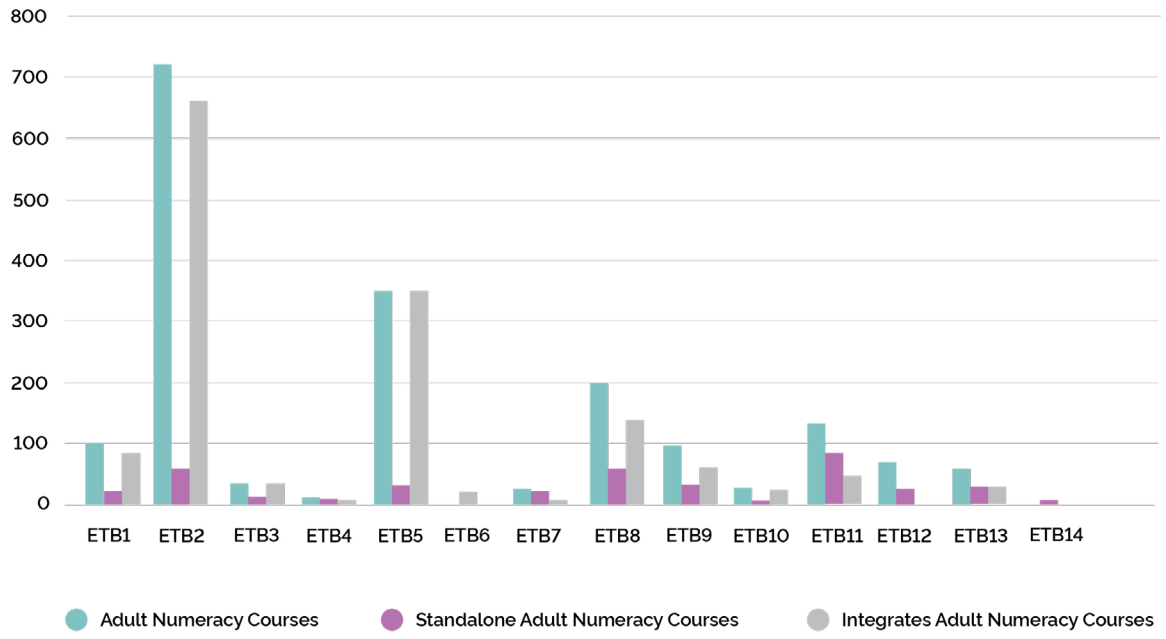


Figure 8. Number of numeracy courses offered in 2018

numeracy courses provided (ETB6 and ETB14 did not provide a response); fourteen ETBs gave the number of standalone adult numeracy courses provided; and twelve ETBs gave the number of integrated adult numeracy courses provided (ETB12 and ETB14 did not give a response). The results are presented in Figure 8.

ETB2 offered a total of 720 adult numeracy courses in 2018, which was substantially higher than the number offered by other ETBs. On the other hand, ETB4 reported the lowest number of courses offered, with a total of twelve numeracy courses offered in 2018. The number of standalone numeracy courses ranged from 0 to 58 in 2018, while the number of integrated numeracy courses ranged from 2 to 662.

Question 15 collected data in relation to the **budget allocated** to adult literacy in 2018 across each of the ETBs. Ten ETBs responded to this question. The highest allocation reported was €2.7 million in ETB12. The median budget stood at €1,200,500.

Following on from the question relating to the budget allocation for adult literacy, **Question 16** asked if adult numeracy was a **distinct budget heading** in each ETB. Fourteen ETBs offered a response with all ETBs indicating that this was not the case. Instead, the numeracy budget was integrated into the overall literacy budget with no specific numeracy budget identified.

Question 17 also focused on budgetary issues as it sought to determine the **money specifically allocated to numeracy courses** in each of the ETBs. However, five ETBs stated that this question was not applicable, a further five ETBs replied that they could not offer a specific figure as there was no separate budget for numeracy (as per Question 16), while two ETBs provided information in relation to the money allocated to numeracy. ETB7 indicated that their numeracy budget stood at €45,000 while ETB8 reported a numeracy budget of €100,000.

Question 18 investigated what **funding** sources, apart from the ETBs, were used to support adult numeracy. Seven ETBs reported that no funds were obtained from other funding sources while three ETBs mentioned businesses and charities that provided additional funding. The responses from these three ETBs are listed below.

- ETB1: NALA funded a trainer for a staff session
- ETB2: DES, ITABE
- ETB5: St Vincent de Paul

Another ETB (ETB12) stated that they conducted a project with local financial institutions and charities, but they did not receive any external funds.

- ETB12: Joint project with MABS, Credit Union, St Vincent de Paul, but did not get funding.

Programme type and duration

Question 19 explored the **range of numeracy courses and activities** provided in each ETB and the opportunities that these offered to adult learners. The results are presented in Figure 9.

In total, fourteen ETBs offered a response to this question and the data collected revealed an extensive number of numeracy opportunities available to adult learners. Seven ETBs reported that the opportunities they provided were not in the given list and each of these outlined additional opportunities that were available. All seven ETBs made reference to *Apprenticeship Support*. ETB9 also alluded to support for ESOL students with less than upper secondary level education and support for students undertaking BTEI and VTOS programmes. ETB12 also outlined how they provided opportunities in relation to *"Maths for college"*.

Questions 20–22 investigated the **number of hours allocated to different types of numeracy courses.** Three ETBs mistakenly thought that these questions were

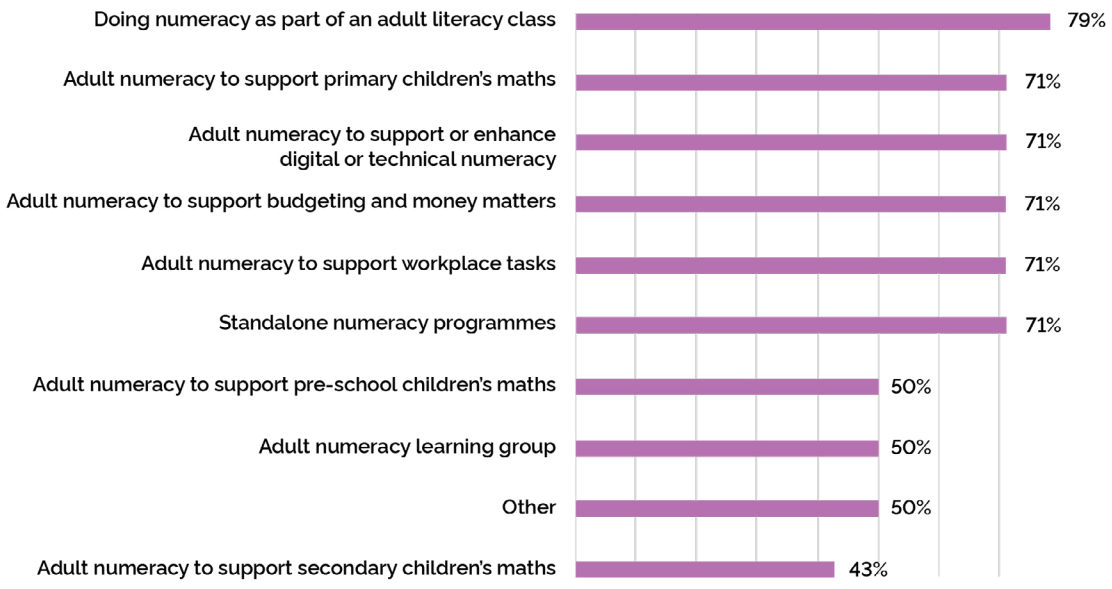


Figure 9. Numeracy learning opportunities

	ETB1	ETB3	ETB4	ETB6	ETB7	ETB8	ETB9	ETB11	ETB13
Adult Numeracy	720	728	600	2,200	1,004	0	2,718	7,980	2,000
Standalone Adult Numeracy	894	374.5	490	0	960	0	1,153	5,100	800
Integrated Adult Numeracy	N/A	897	110	2,200	44	0	1,565	2,880	1,200

Table 4. Provision of Hours for Numeracy Courses

previously asked in the survey (Questions 12–14) and so did not provide an answer. However, nine ETBs offered approximate figures and these are presented in Table 4.

There was a large spread in the responses received, with hours for numeracy courses across 2018 ranging from 600 to 7,980. In the majority of ETBs more hours were allocated to integrated adult numeracy courses than standalone courses.

Question 23 gathered information relating to the **average length of the numeracy courses** offered across the ETBs. Thirteen ETBs offered a response to this question but the unit of time differed between responses, with some giving the duration in hours, others in weeks and others in months. As a result, it is difficult to interpret these responses. Some sample answers are "18 weeks", "2 hours per week", "30", "13 weeks at 2 hours per week".

Question 24 queried whether ETBs tended to offer **one-off numeracy courses/activities** for adult learners. Fourteen ETBs offered a response and the results are presented in Figure 10.

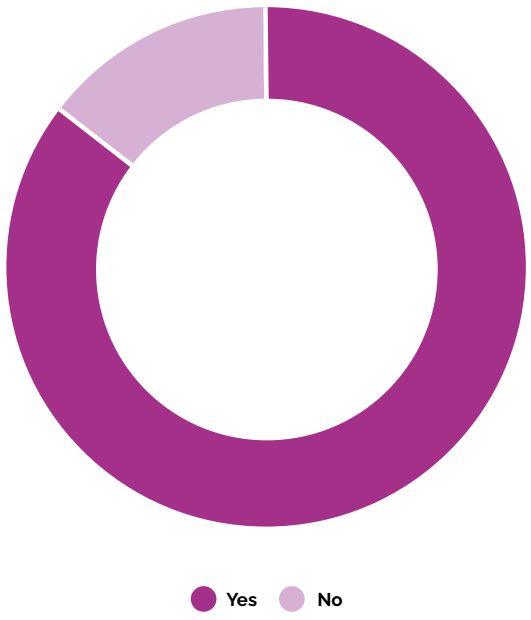


Figure 10. Provision of one-off numeracy activities

The large majority of ETBs (n = 12) indicated that they did not provide one-off courses for adult learners. While two respondents outlined that they did provide such courses, they did not provide any figures information in relation to the nature of these courses, despite being given the opportunity in the survey to do so.

Question 25 sought to investigate the **level of adult numeracy currently being offered** across ETBs. This was presented as a multiple-choice question with respondents having the opportunity to select all answers that were relevant to them. The results are presented in Figure 11.

Level 2 and 3 QQI courses were the most popular courses offered across the ETBs, followed closely by programmes offered through the adult literacy service. No ETBs offered Junior Certificate or Leaving Certificate higher-level courses while a small minority offered courses at ordinary level. Four ETBs indicated that they offered additional levels to those listed, and when asked to elaborate on this all four stated that they provided mathematics for apprentices.

Recruitment and referrals

Question 26 asked about **methods of recruitment or referral** of adult learners. The results are shown in Figure 12. Respondents could select from a list of eleven options and eleven of the fourteen ETBs selected all of the first nine options. Nine ETBs stated that the NALA telephone helpline was used for recruitment purposes while five ETBs stated that they recruited adult learners using alternative methods, including:

- a Career Guidance service and liaison with various networks (ETB1);
- as part of an apprentice induction programme (ETB2);
- through [local ETB] website, [local ETB] course directory, advertisements in local church newsletters and posters (ETB3);
- through Facebook and Google searches on the website (ETB4);
- community networks and local organisations (ETB12).

Programme outcomes

Questions 27 and 28 asked whether quantitative or anecdotal **evidence of outcomes** from adult numeracy activities had been gathered. Responses were provided by fourteen ETBs. The results are shown in Figure 13. Questions 27 and 28 are discussed together.

In total, fourteen ETBs responded to each of these questions.

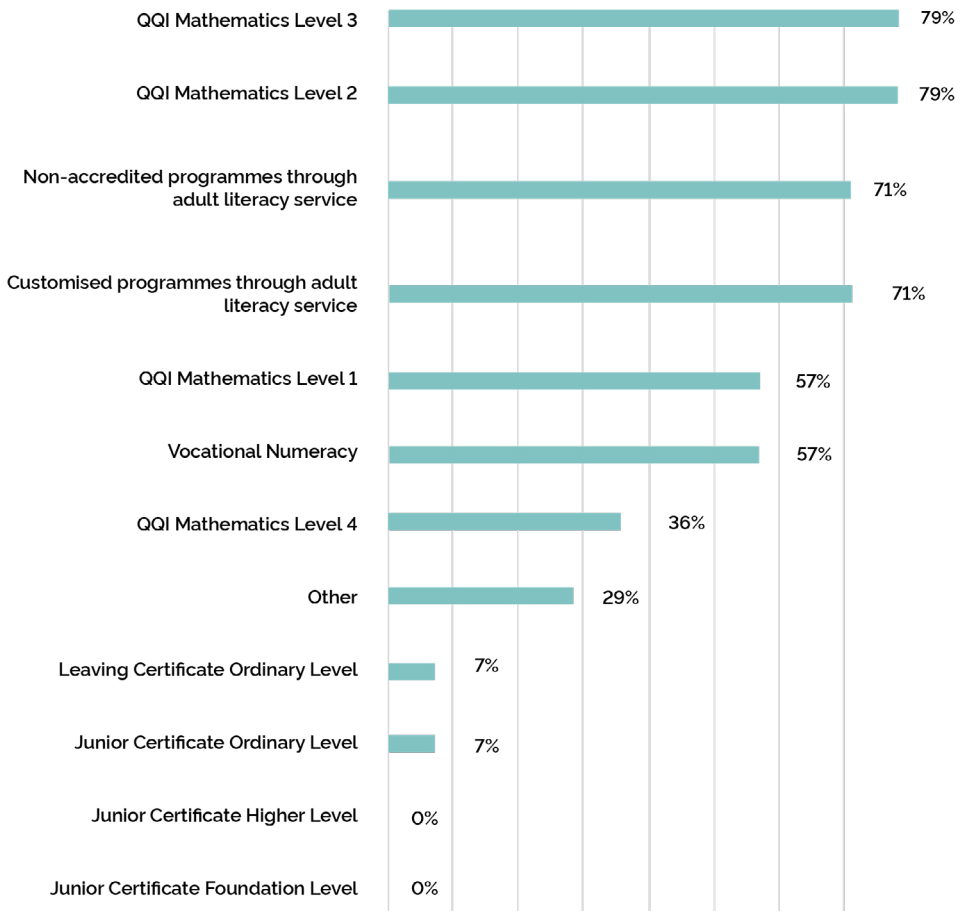


Figure 11. Level of adult numeracy offered

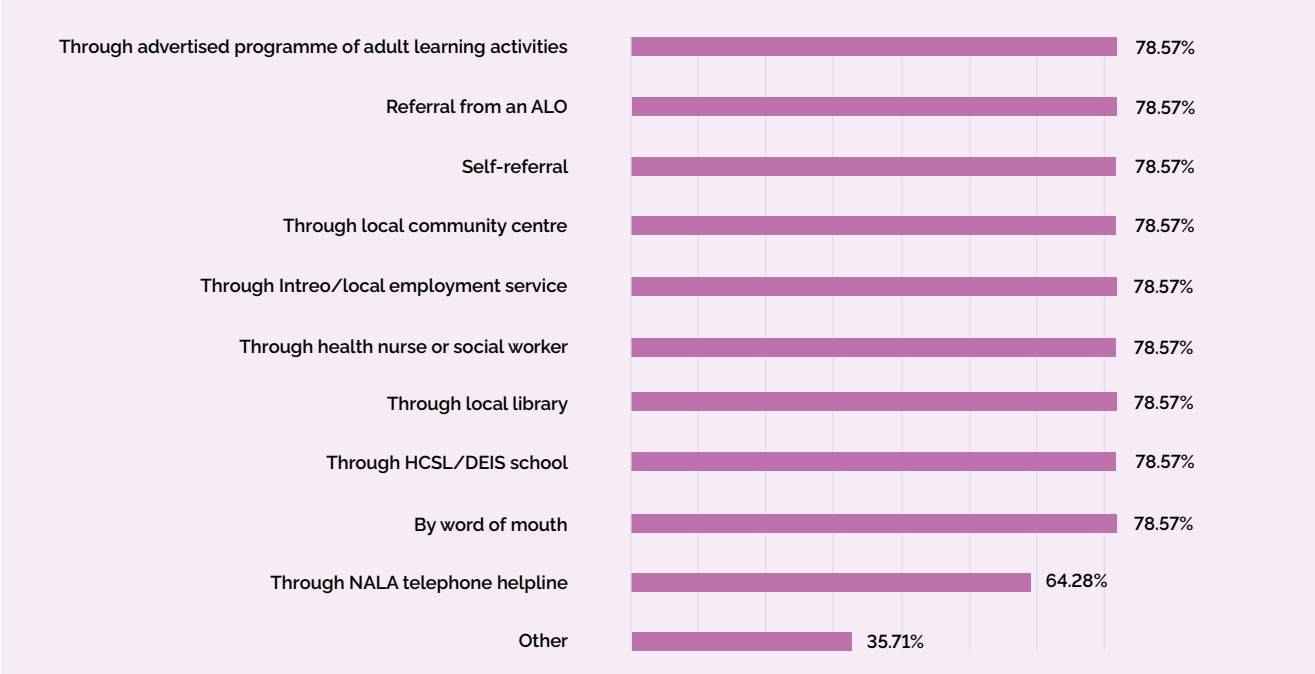


Figure 12. Recruitment and referral of adult learners

The PLSS database was used by the majority of respondents (77.8%) to collect quantitative evidence of these outcomes. The majority of ETBs surveyed (n = 10) felt they had quantitative evidence of adults progressing into other learning.

In terms of a wider range of outcomes, more ETBs indicated that they had collected anecdotal evidence as opposed to quantitative evidence in relation to positive outcomes from adult numeracy activities such as : adults becoming more confident in (a) their

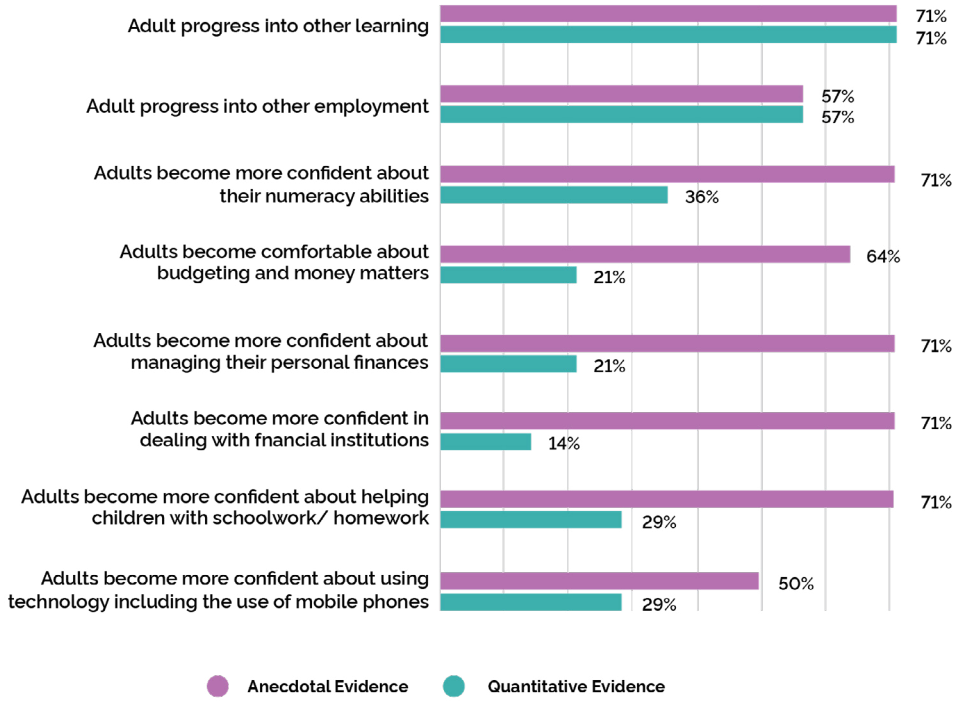


Figure 13. Quantitative and anecdotal evidence of improved outcomes

numeracy abilities; (b) budgeting and money matters; (c) managing their personal finances; (d) dealing with financial institutions; (e) helping children with homework; and (f) using technology. This is understandable, given the limited availability of data. Learner feedback and conversations with tutors were reported as the method used to collect anecdotal evidence from the majority of respondents (63.3%),

Assessment, accreditation and evaluation

Question 29 enquired whether the numeracy courses in each ETB were accredited. All of the thirteen ETBs that responded to this question noted that their courses were accredited. As outlined in Figure 14, the level of QQI accreditation ranged from Level 1 to Level 4 across the ETBs. While eleven of the thirteen ETB's had Level 2 numeracy courses accredited, only four had Level 4 courses.

Question 30 enquired whether **initial assessment** is a part of adult numeracy provision. Of the thirteen ETBs who responded, twelve responded "yes". In the main, this assessment was carried out by an ALO and/or a tutor. Following on from this, **Question 31** asked whether **summative assessment** is a part of adult numeracy. Similarly, of the thirteen ETBs who responded to this question, twelve responded "yes". In each case, this summative assessment was carried out by a tutor.

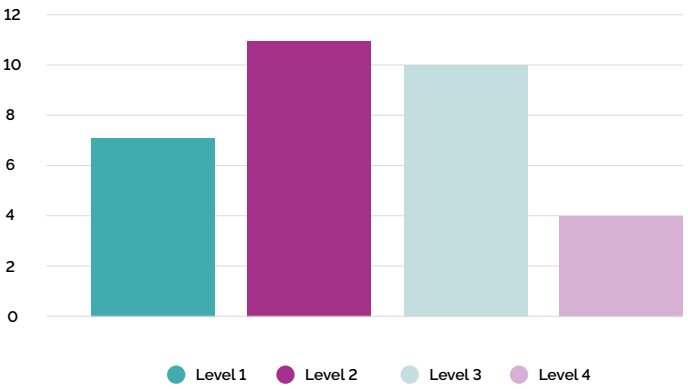


Figure 14. QQI accreditation level of numeracy courses in ETBs

Question 32 queried whether the adult numeracy programmes were **evaluated.** Such evaluation was confirmed in twelve of the thirteen responses. **Question 33** looked for information about who **participated in the evaluation.** The responses demonstrate that course participants and course tutors most frequently evaluated courses, with occasional inclusion of ALOs and resource workers.

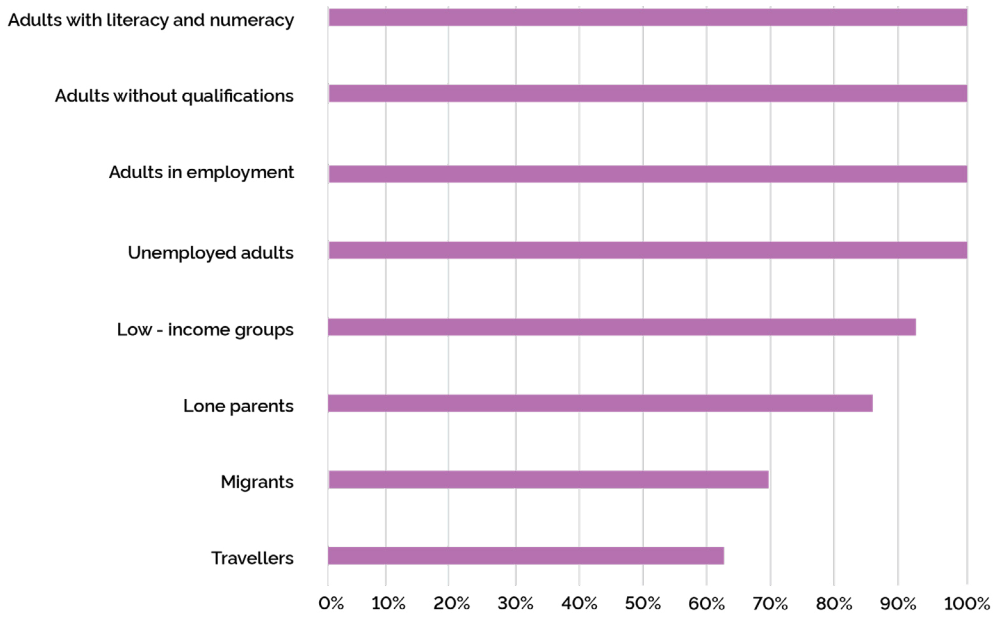


Figure 15. Groups that participate in adult numeracy

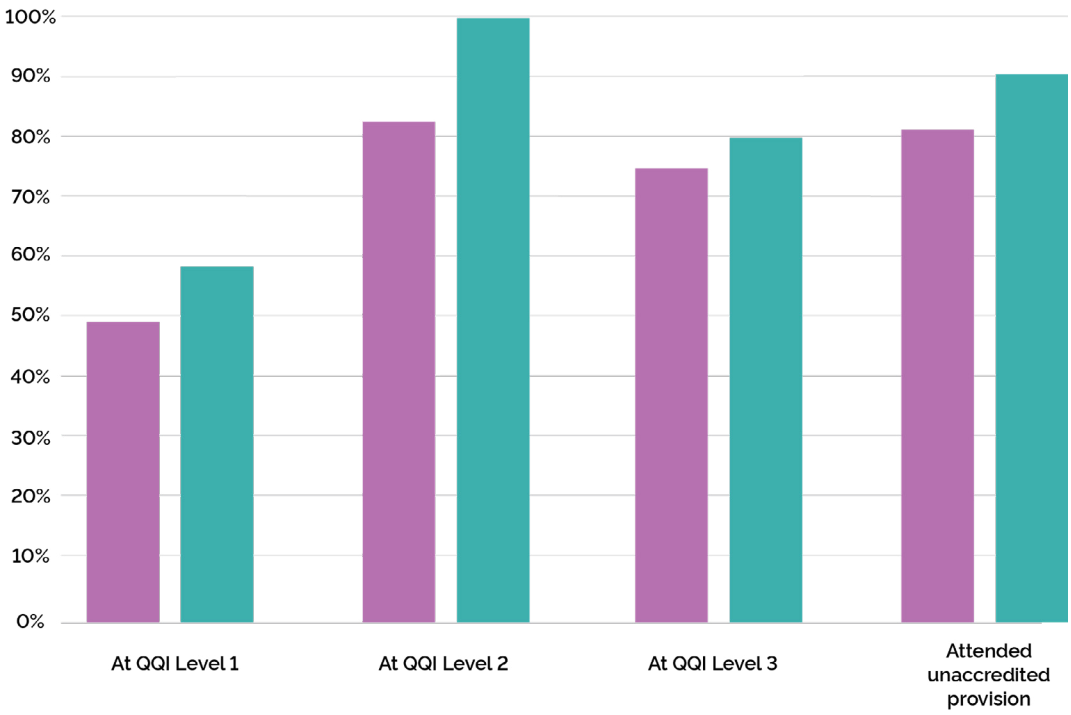


Figure 16. Gender of those attending adult numeracy courses

Participants

Question 34 sought evidence of the **particular groups** that become involved in adult numeracy courses. The data shows that adult numeracy reaches a wide number of the groups most in need of support in redressing educational inequalities (see Figure 15).

Other groups reported in response to **Question 34** included those completing an apprenticeship, a QQI Level 5 or Level 6 in Agriculture (Green Cert), or those with learning difficulties and/or Special Educational Needs.

Question 35 explored data in relation to adult numeracy **participant numbers** in 2018. The data from ten responding ETBs had a range of 45 to 4,322 participants. The median number of participants was 310.

The **maximum number of participants per course** was the subject of **Question 36.** The data for this question ranged from 6 to 18 participants as the maximum number. The modal maximum number was 8 participants (given by five of the eleven responding ETBs).

Question 37 sought data about the average number of adults who **completed the course.** While these responses varied, depending on the participant numbers attending, the average number of adults who completed the course was 71%.

The ETBs estimated that 70% of adult numeracy learners per year **progress to other adult learning (Question 38).**

Question 39 and **Question 41** asked about the **number of men and women who attended** adult numeracy in each ETB in 2018. In relation to men, the data from ten responding ETBs ranged from 17 to 1500 attendees. The median number of men who attended in each ETB was 124. With regard to women, the data from ten responding ETBs ranged from 28 to 3049 attendees. The median number of women who attended in each ETB was 183.

More specifically, **Question 40** and **Question 42** asked about the **number of men and women** who attended adult numeracy at specific QQI levels of unaccredited provision in each ETB. These data are displayed in Figure 16. It shows that, overall, the number of women attendees outnumbered men at each level, with QQI Level 2 being the most popular across both sexes.

Partnerships

Question 43 enquired as to whether the ETBs organise adult **numeracy activities in partnership** with other groups or organisations. Of the thirteen ETBs that responded, twelve responded "yes". The main groups or organisations with which ETBs work was the subject of **Question 44.** Responses are illustrated in Figure 17, which confirms that the most frequent partners include:

- Local schools
- Local community groups
- Home School Community Liaison (HSCL) schemes and
- TUSLA

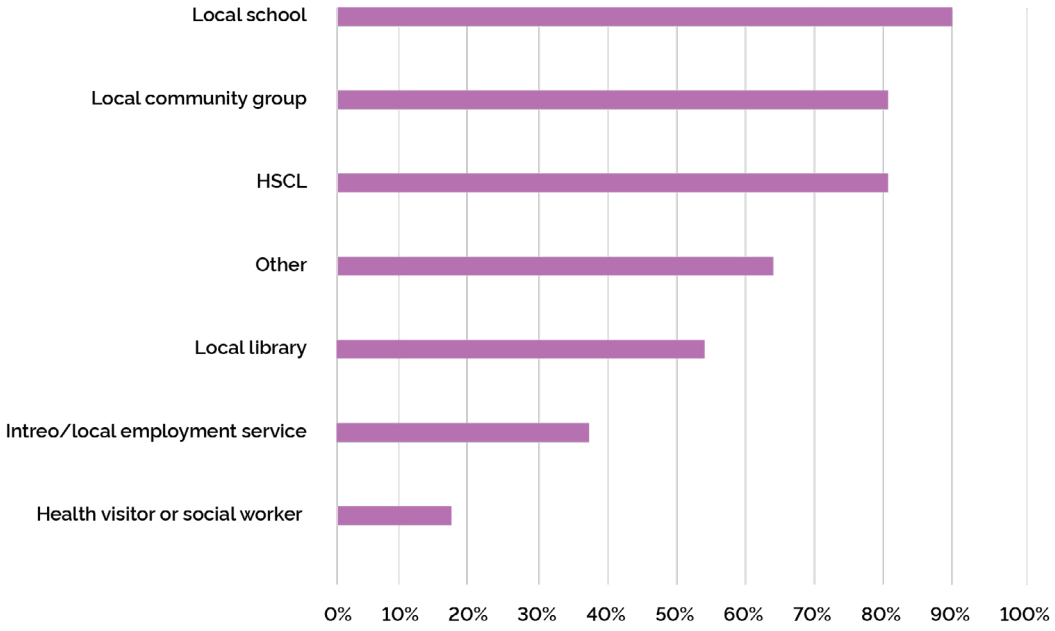


Figure 17. Collaborative partners in ETB adult numeracy provision

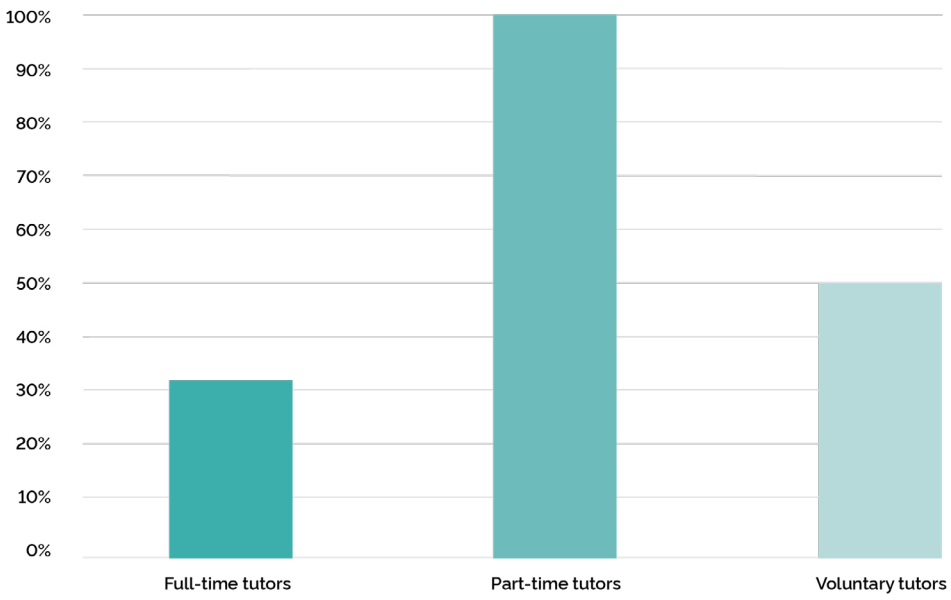


Figure 18. Adult numeracy tutors

Other partners noted in response to Question 44 include Special Educational Needs providers, St John of Gods and Local Mental Health Day Centres, Training Centres and PLC colleges, Disability Groups, Regeneration projects, local credit unions and St Vincent de Paul.

Staff and training

In all twelve ETBs that responded, **Question 45** provided evidence that adult numeracy is predominantly **dependent on part-time numeracy** tutors. Part-time tutors are involved in 100% of adult numeracy provision. Only three ETBs have full-time staff members involved in adult numeracy, and six ETBs use volunteer tutors in adult numeracy provision (see Figure 18).

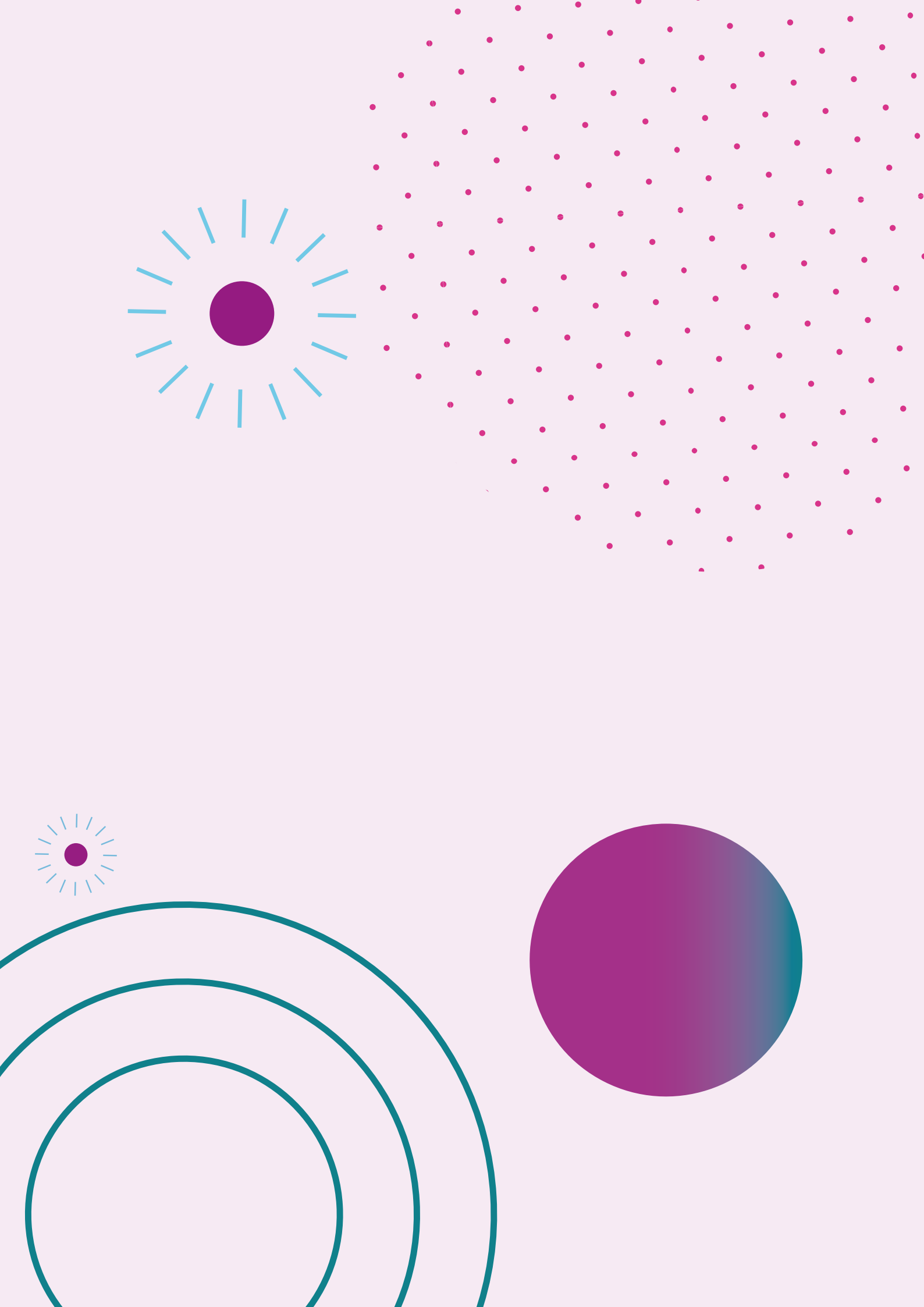
Questions 46–50 examined the **availability, uptake and demand for training and CPD** for those involved in the delivery of adult numeracy. All but two ETBs had training available for adult numeracy tutors. Data around the percentages of those working in adult numeracy who had received training in the past year, five years and ten years was sparse. However, for those ETBs that responded and for which the data were available/known, the averages were 47%, 59% and 65% respectively. Nine out of the thirteen ETBs felt that there was not an unsatisfied demand for adult numeracy CPD.

Question 51 asked for any **other comments**, and seven ETBs responded. One respondent noted that although they identify high need for numeracy provision, there is **low demand/interest** in this subject area. Two of the responses identified a **need for CPD** in numeracy provision, especially in specific areas such as maths for farmers, maths for SVDeP, MABS budgeting ideas. The importance of an **integrated approach** to numeracy was mentioned in two responses. One of the benefits of such an approach was to build students' confidence before they embarked on standalone numeracy classes. Finally, one respondent noted that information on adult numeracy provisions is difficult to draw from each individual ETB. The information might be richer at centre level.

Conclusion

The following points sum up the main evidence that emerged from the survey data.

- The data indicated that substantially more adults attended integrated numeracy courses than standalone numeracy courses.
- The majority of ETBs (78.6%) reported that the provision of numeracy courses was sufficient to meet demands in their region.
- The survey data showed a lot of variation in terms of the number of adult numeracy courses offered across the different ETBs in 2018. The number of courses available to adult learners ranged from 720 courses to 12 courses across the 14 ETBs.
- In general, the survey indicated that ETBs were not in favour of offering once-off numeracy courses or activities, with 85.7% of respondents stating that these were not offered in their ETB.
- When evaluating the positive outcomes of adult numeracy initiatives, ETBs had gathered a lot more anecdotal evidence than quantitative evidence. Conversations between tutors and learners were the most common way that anecdotal evidence was collected across the majority of ETBs surveyed.
- All of the ETBs provided accredited numeracy courses (generally ranging from QQI Level 1–4), with QQI Level 2 being the most common.
- An initial assessment of adult numeracy was generally carried out by an ALO and/or a tutor. Following this, summative assessment was carried out by a tutor.
- In the main, nearly all of the adult numeracy programmes were evaluated, generally by course participants and course tutors.
- The survey data highlighted that a wide range of groups become involved in adult numeracy courses. The median number of participants in such courses was 310, with more women than men generally attending. On average, 71% of learners complete the course and 70% progress to other adult learning.
- There were some numeracy activities organised in partnership with other groups or organisations, most commonly local schools, local community groups, and HSCLs.
- Adult numeracy is predominantly dependent on part-time numeracy tutors. Only three ETBs had full-time staff members involved in adult numeracy. By and large, there was training available for adult numeracy tutors in each ETB, with 47% of those working in adult numeracy having received training in the past year.



Chapter 3.
Interview Analysis

Methodology

Interviews were conducted by NALA staff with Adult Education Officers (AEOs), Adult Literacy Organisers (ALOs), tutors, and adult learners across 16 ETB sites. Two different interview schedules were used, one for ETB **staff** (AEOs, ALOs, tutors) and one for **adult learners.** The interview schedules are provided in Appendix 2. Some interviews were conducted with individuals and others with focus groups. Altogether, 47 interviews and focus groups were conducted, with 9 individual interviews and 38 focus groups encompassing the following participant combinations:

- AEOs and / or ALOs
- Tutors and ALO/AEOs
- Tutors
- Adult learners

De-identified interview transcripts were provided to the research team for qualitative content analysis. Transcripts were analysed by creating a table for each interview to copy and paste transcript excerpts into cells defined by the respondent group and the interview theme. The interview theme refers to a cluster of questions under a common heading in the interview schedule. In the interview schedule for ETB staff there were 11 clusters of questions, and in the interview schedule for adult learners there were four clusters of questions. Table 5 shows an example of a transcript analysis table, and how interview themes were linked to question clusters for the different participant groups.

The analysis process made it possible to compare responses from each participant group (AEOs/ALOs, tutors, and adult learners) on a similar theme (e.g., the similarities and differences between tutors' and adult learners' conceptions of numeracy, or of the activities offered in numeracy courses), and to compile responses from the same groups on each theme (e.g., how tutors conceptualise numeracy, or what benefits adult learners see in participating in numeracy courses). Four members of the research team undertook three rounds of analysis of transcripts. In the first round, 20 transcripts from six ETB sites were shared between research team members for initial analysis to test the process outlined above. After the team met to compare findings and verify interpretations of transcript excerpts in terms of interview themes, a second round of analysis was undertaken, involving scrutiny of nine transcripts from a further four ETB sites. Once again, the team met to compare interpretations of this second group of transcripts. At this stage it was apparent from inspecting the transcript analysis tables that the analysis had reached saturation, since no new insights were emerging. Thus, the third round of analysis involved only a scan of transcripts from the remaining six ETB sites to check for any further examples or contradictory evidence.

Instead of presenting the results by summarising responses to each interview question/cluster, research questions (RQ) were developed to probe underlying issues. Interview question clusters were mapped onto the research questions as follows:

RQ1: How do adult learners and tutors conceptualise numeracy? *(Staff: Ethos)*

RQ2: How are adult learners recruited; how do they access courses; and what barriers do they experience? *(Staff: Access, Recruitment; Adult learners: Engagement, referral, enrolment)*

RQ3a: How are programmes planned; what activities are offered and how are they experienced by adult learners?

RQ3b: How important is accreditation? *(Staff: Programmes/activities, Delivery; Adult learners: Experiences)*

RQ4: What are the benefits experienced by adult learners (of participating in courses)? *(Staff and adult learners: Numeracy benefits)*

RQ5: What qualities, skills and knowledge do tutors need to work well in adult numeracy? *(Staff: Tutors; Adult learners: Experiences)*

The interview analysis findings were then interpreted in light of issues identified by the literature review of national and international policy and practice in adult numeracy *(Chapter 1 of this report).*

Results

How do adult learners and tutors conceptualise numeracy?

Two different conceptualisations of **numeracy** were evident. The first sees numeracy as foundational mathematics for trades /craft apprenticeship. In such cases, numeracy would be taught as standalone courses to apprentices who had particular gaps in their mathematical knowledge. Similarly, such courses were usual for adults in other FET programmes who required dedicated tuition on foundational principles of numeracy.

> ***Tutor:*** *Well what I do with the apprentices would be just maths as well but very focused on trades. (Site 12)*

> ***ALO:*** *And then we have different types of maths. So it would be – we could have maths and electrical skills. So it's kind of providing a grounding for them if they want to be an apprentice. (Site 11)*

Interview theme	Question cluster headings for participant groups		
	AEO/ALO	Tutor	Adult learner
Adult learner characteristics and background	N/A		Participant profile
Ethos: Values that inform adult numeracy (includes conceptualisation of numeracy)	Ethos	N/A	N/A
How numeracy programmes/activities are developed Accreditation	Programmes/activities		N/A
Access: How participants access numeracy programmes Barriers to participation	Access		Engagement, referral, enrolment Experiences
Recruitment of participants	Recruitment		
Delivery of numeracy sessions, including relationship between tutors and learners	Delivery		Experiences
Assessment of numeracy tuition	Assessment		N/A
Evaluation of numeracy programmes	Evaluation		N/A
Tutors: Qualities, skills, knowledge needed	Tutors		Experiences
Progression options for adults after completing programme	Progression		Experiences
Benefits for adults (and their families, schools, communities) from participation	Numeracy benefits		Numeracy benefits
Partnerships with local communities	Partnerships		N/A
Recommendations for good practice guidelines	N/A		N/A

Table 5. Transcript Analysis Table Linking Interview Themes to Question Clusters

The second is functional numeracy, taught in an integrated fashion to adults who are disadvantaged in everyday life by unmet numeracy needs. "Integrated" can mean integrating numeracy into everyday life contexts, as well as integrating numeracy into other courses taught in the ETB centre.

Tutors and ALOs/AEOs across a wide range of sites referred to numeracy as the practical application of mathematics in real-world contexts.

> ***Tutor:*** *There's maths for studying maths and then there's maths for living. So I think it's maths for living, isn't it, that we're focused on? (Site 5)*

> ***Tutor:*** *I teach maths as maths in everyday life. So when I think of adult numeracy I think of money, buses, numbers, pizzas. (Site 4)*

> ***ALO/AEO:*** *Using practical everyday maths that people need in terms of change and measuring and baking or whatever. (Site 4)*

Many interview participants also mentioned that numeracy involves developing confidence, as well as the ability to question authority and participate in the community.

> ***ALO:*** *We want to bring numeracy to life. And like that the orienteering or practical things, giving someone a skill, an experience, a confidence in doing something they didn't think they'd be able to do. (Site 6)*

> ***Tutor:*** *Personally, I think it's to give people the confidence to question and to be more active in their communities. To be more vocal and to not sit back, but to have the confidence to read numbers and take part in numbers. (Site 6)*

However, there was also some evidence of a narrow view of numeracy as the ability to get the right answer to a mathematical calculation.

> ***ALO/AEO:*** *It's a very straightforward subject, you know, it's very black and white. You get a right answer. It's much more straightforward than literacy, isn't it. (Site 4)*

Despite this viewpoint, there was a consistent theme throughout all interviews supporting the non-judgemental, student-centred **ethos** of adult education, including adult numeracy education. There were obvious contrasts between this supportive educational ethos and the experience of learning mathematics at school alluded to by both staff and adult learners.

> ***Adult learner:*** *In secondary school we had a useless teacher. (Site 6)*
>
> ***ALO:*** *They cower at home because somebody told me in school you're no good at maths because you can't do that algebra. (Site 8)*
>
> ***ALO:*** *It's [i.e., the experience of attending adult numeracy course] so different from when they were in school to have an enjoyable experience. (Site 6)*
>
> ***Tutor:*** *Just lack of confidence in their own ability … I think for the older ones who have retired, they had such a traumatic time in school. (Site 6)*

It was also clear from the interview responses that the experience of learning school mathematics does not necessarily make students numerate.

> ***ALO/AEO:*** *One of the sad things within the last year is that the number of young people, I'm talking in their early 20s, late 20s, that are coming forward with numeracy difficulties is unbelievable. (Site 5)*
>
> ***Adult learner:*** *I got lost in I can't remember even what it was. Subtraction, I think, and all that. And then I just got left behind. I just never understood it. (Site 16)*
>
> ***AEO:*** *And so many of them, and I don't know what happened, but so many of them would cite the introduction of long division – not long multiplication but long division – as the moment that they lost something and they struggled with the concepts. And I think at that point they never progressed beyond that because whatever way it was taught or whatever way their minds were working – and so many of them would say, if you'd say to them, you know, if you were in school, kind of what age or what stage did you first – so many people would be saying 3rd, 4th class, and it was always long division. (Site 16)*

Based on these findings, it appears that ETB staff and adult numeracy tutors have intuitive, but rather fragmented, views of numeracy and how to support adult numeracy learning. What is lacking is a clear conceptualisation of what numeracy is (not as foundational mathematics). Such a conceptualisation is provided by the numeracy model we have developed (Goos et al., 2014), which includes the elements of mathematical knowledge, dispositions, tools, contexts, and a critical orientation to the world. Tutors did refer to each of these elements when describing their understanding of numeracy, but their ideas were not organised in a way that could inform their instructional planning or practice.

How are adult learners recruited; how do they access courses; and what barriers do they experience?

All ETB centres reported a variety of **recruitment** strategies, but sometimes these seemed rather ad hoc. They included print/radio/television advertising, referrals from social welfare agencies, home–school liaison officers or programmes, and liaison with other community groups. It was not clear whether this recruitment was generic or numeracy-focused. Also implicated in this issue is the question of whether numeracy education is delivered in standalone courses or integrated into other programmes. People's attitudes towards numeracy and mathematics were recognised as a factor discouraging participation in any kind of numeracy programme:

> ***ALO:*** *But I think nobody ever comes in and says, 'You know what, I'd like to do numeracy.' Or even mathematics, you know. (Site 11)*

One staff member (ALO or AEO) drew attention to the value of informal recruiting to numeracy after people have enrolled in a different course.

> ***AEO/ALO:*** *But the other thing about numeracy is [that] at times people come in for reading and writing and they're in a group and then suddenly they discover, hold on, there's a numeracy thing going on there. I think there's a bit of shame that my numeracy isn't great so, you know, that's the good thing about integrating numeracy into the programmes because then if they want they can go into we'll say a numeracy-based course. (Site 5)*

Nevertheless, there is a case for numeracy-specific recruiting, perhaps by using radio spots featuring adult numeracy learners talking about their experiences.

Overwhelmingly, the main **barrier** experienced by adult learners is affective: fear, anxiety, stigma, and lack of confidence were frequently mentioned by ALOs/AEOs, tutors, and adult learners alike.

> ***Tutor:*** *Fear, yeah they're terrified, they hear the word maths and they just blank out so I think the word maths is the wrong name for it. (Site 6)*
>
> ***Adult learner:*** *When I was going to school I got very little school. And I was being a Traveller in amongst a load of settled people, I got it very, very rough from the beginning when I was young. (Site 5)*
>
> ***ALO:*** *The formality, the idea of having to go in and meet somebody and sit down and explain your difficultly. Especially to somebody local. So the fear a lot of people would have is that I'll meet my neighbour. Or it'll be someone I know will be*

working in there. And I'll have to explain to them why I'm after walking in the door. (Site 6)

Other barriers to accessing courses include family commitments and lack of transport.

> ***Adult learner:*** *But it's just to get you here, like I'm twelve miles away and it's kind of hard to get in from, I get the bus one day a week and I suppose it's hard to get by, you know. (Site 6)*

How are programmes planned, what activities are offered and how are they experienced by adult learners? How important is accreditation?

There is some way to go to ensure consistent approaches to programme **planning** for numeracy across the sector. However, tutors in their respective ETBs are generally very committed to designing flexible teaching sessions that respond to adult learners' needs:

Tutors are generally very committed to designing flexible teaching sessions that respond to adult learners' needs:

> ***Tutor:*** *There's huge flexibility [depending on learner characteristics and background]. I can actually shift them around, or I can shift them backwards or whatever. I can be doing addition today, and I can be doing perimeters tomorrow. (Site 4)*

ALOs also pointed out the opportunities for flexibility within an indicative planning framework:

> ***ALO:*** *The QQI, the indicative content is not you have to stick to this, you can put whatever you want into it. Cover whatever you need to cover for the portfolio, fatten it up with everything else that you can throw at it throughout the year I think. And whatever the learner wants to do. (Site 8)*

However, there was also evidence of more structured approaches to planning and delivery:

> ***ALO:*** *So if it's not a Level 2, or a Level 3 it's just that they're integrating numeracy. Well then it's tutors create their own resources. If it's a Level 2, or a Level 3 programme, we have tutor folders. And they have been in essence vetted or approved. They've been quality assured that they're meeting the learning outcomes. And then as that tutor folder goes through the process and more materials might be developed, it's updated every time that it goes through. (Site 6)*

There is a need for tutors (and possibly more senior staff) to be provided with continuous professional development (CPD) on programme planning. In particular, staff would likely benefit from learning more about differentiation of curriculum planning and contingent responsiveness during numeracy sessions to support adult learners with diverse needs, as alluded to by this respondent:

> ***AEO:*** *And I think planning is so important because you have to be prepared in your sessions for anything to happen. One of the questions we often ask at interview for tutors is, you know, you've a beautifully planned session and you have all your resources and you're ready to go, and you go in and after three minutes it falls apart. They're not – and I suppose the more experienced you are, the more you prepare in terms of your planning for all eventualities, you know. So I do think good planning is actually really, really important. I mean, because sometimes you have that thing where you have to scrap the whole lesson that you had planned after three minutes. So where do you go then? What resources are you drawing on at that point?! (Site 16)*

Learning activities described by tutors are mostly very practical, contextualised, flexible in responding to adult learner interests and needs, including those of apprentices in specific trades, and are different for each centre.

> ***Tutor:*** *… say for example with pre-apprentices, if they're working as mechanics and I say you're going to have to paint a car, you're going to get special paint and it's going to have to be in a ratio of one type of paint to another type of paint and you're going to have to figure out how much you need. (Site 6)*

> ***Tutor:*** *… it's based on their everyday maths needs. So maybe if it's topical like we might talk about rugby this week, because the rugby world cup is on and we'll talk about that. So being topical and being within their needs really. (Site 6)*

> ***Tutor:*** *I have a bag – people laugh at me – I've got my bag of recycling, it's not recycling its food packaging. Because you get hours of – you know, you've got decimals, you've got fractions, you've got percentages. You've got data tables, you've got dates, you've got codes. And you will get a good two-hour class out of people, just identifying the numbers that are in that. (Site 12)*

Likewise, adult learners described a wide range of practical activities that developed their numeracy capacities:

> ***Adult learner:*** *But for shopping though, it's great, you know what we've learned in here in the centre it applies to the shopping, it's great, you know discounts and everything like that, working out the discount and everything, you know it's so wonderful. (Site 8)*

> ***Adult learner:*** *For us then it was the measurements of windows for curtains and stuff like that. So that kind of came back and helped us in our own personal lives as well. How to use a measuring tape properly. You know you might be out two little lines but that makes a big difference*

when it comes to material or whatever. (Site 9)

Adult learner: *Double payments, but where I actually learnt through actually adding up was by playing darts. That's how I got to learn how to add and subtract. (Site 9)*

There were many examples of tutors describing how they create a variety of resources (as above), but they may benefit from learning how to adapt existing resources to suit adult learners with different needs, as suggested by the following comment:

Tutor: *I don't find a lot of low-level numeracy resources age-appropriate. (Site 5)*

One way to address this issue would be to provide tutors with a suite of exemplar resources, together with guidelines on how to adapt these to suit the needs of their learners or to relate the resources to different everyday contexts.

Adult learners appear to be happy with the learning activities offered, and especially with the tutors' kindness and approachability, as well as the non-threatening learning environment that usually contrasted with their prior experience of learning in school.

Adult learner: *It's a very safe environment and we all feel comfortable. And usually when I was going to school you'd never ask a question in class because you'd be made to feel so stupid whereas here in ETB you can ask any question you like. (Site 5)*

Adult learner: *The ironic thing for me, the building that we're in, the old technical school, I was sent there but I didn't want to go, I wanted to leave school in sixth class, I didn't want to go and I had a battle with my parents and they made me go and I lasted six weeks and I literally ran out of it. Now I look forward to going back into that building. (Site 13)*

ETB staff were asked about the value of **accreditation,** and there were mixed responses. Generally, they considered this is not the top priority for adult learners who are more interested in developing practical life skills than obtaining a certificate.

AEO: *I think it [accreditation] should be offered as an option but it can't be the first port of call. (Site 5)*

However, there was acknowledgement amongst staff and adult learners that those who progressed to higher-level courses gained great satisfaction and affirmation from formal accreditation and certification.

Tutor: *I had one man in particular, he's never got a cert in his life. And he's so excited at the thought, he's got his cert now but he'll be picking it up at the presentation, it means so much to him. I suppose as you say you kind of forget about what it means to a person … maybe we have had lots of certs over our lifetime, but really I find in the classroom that it definitely – and the night, the celebration night itself, you can see how proud, they're nearly on the cloud they're that delighted with themselves. (Site 8)*

Adult learner: *I think it's very important to be certificated, you know, if you're going out … looking for work. (Site 7)*

Adult learner: *And don't get me wrong, when I get the certificate I'll be all as proud as punch, you know what I mean, but I went in initially to try and support my family. (Site 16)*

What are the benefits experienced by adult learners (of participating in courses)?

Overwhelmingly, the main **benefit** identified was the increase in confidence experienced by adult learners. This was often described as a transformative experience that changed their lives.

AEO/ALO: *One of the things that I heard here recently is that somebody, she was used to handing in say €10, no matter what she was asked for, it was €10 or €20, she had no idea what change she was getting back. Now she has learned to do estimations that it should be, we'll say its €2.50 or whatever, that she should be getting back paper money as well. And now she has the confidence to say, 'Are you sure that change is right?' Because the poor woman, she was actually being done in a shop because the person that was behind the counter actually knew that this person … (Site 5)*

Adult learner: *I'm more confident now to go in say to the ATM machine and know I'm not pressing the wrong buttons and stuff like that now. That used to be my biggest fear because they come up on the screen and if you ticked the wrong thing it's gone into something else so you don't know whether you are after doing harm to yourself. Whereas now I can walk up and I'd have no problem doing it, you know what I mean. (Site 9)*

Adult learner: *It's a great confidence booster. When you have, like, answers done and you're flying through it, you just feel amazing, like. It's a great confidence booster. Even outside. If somebody asked me a question about something or somebody asked you for help, you're just like, yeah, I know how to do it. (Site 11)*

Coupled with this confidence boost was the recognition by adult learners that they had developed new knowledge and understanding.

Adult learner: *The light bulb comes on when it's explained, but you didn't understand all them years ago. But now it's just – I used to hate it. (Site 16)*

Adult learner: *I find also that … I've learned a little bit more about measuring stuff within the house. So I wouldn't have a clue how to measure a carpet, wouldn't have a clue how to measure lino. But now*

I kind of have a rough idea, you know, and I'm able to figure that out. (Site 16)

Adult learner: *And if you see a sale and it says 25% reduction, you know that's a quarter, you know. That's only simplifying … And the other example is do you know these tax codes now, I think there's 23% on certain clothes or whatever. And restaurants are 9%, all them things, you'd understand them things. (Site 6)*

Tutors and ETB staff similarly recognised that adult learners benefited from developing financial awareness and problem-solving skills.

ALO: *But then if it's about their budgets, obviously that totally empowers them, because that means for their household budgets or whatever they're more in control and maybe their lives are more in control, you know. (Site 11)*

Tutor: *I think maybe problem solving, you know… Just in an everyday situation that if you've more confidence with numeracy that you're better able to solve, do problem solving. (Site 6)*

Adult learners also benefited from being able to support family members in numeracy tasks, even helping their children with homework.

ALO: *And for parents, I mean, the fact that they now can sit down and work with their kids, it makes them feel more confident around their kids. (Site 11)*

Adult learner: *Children I think, basically. Help them to do sums and how to do this, that and the other. And you'd be embarrassed when it comes to your own kids that you can't actually help them. (Site 6)*

Adult learner: *I find it great because I do have a son with special needs who struggles with maths. So for me it was fantastic that I was able to learn like the bits with him, you know. (Site 16)*

Some reported further benefits such as improved mental health.

Adult learner: *See, there's a lot of people living on their own, it's great to have a chat with a group of people. You could call this the academic side of the men's sheds. (Site 6)*

Adult learner: *If you stay at home you get kind of isolated, you know some people say they're only looking at four walls. Whereas doing something here, the day goes a lot quicker. And you're keeping your mind active as well. (Site 6)*

Adult learner: *Yeah, and to get out of the bed – it's something to get up for. (Site 9)*

There were also profound social benefits in adult learners' participation in numeracy programmes, as many referred to the enjoyment and satisfaction that adult learners experienced in this as a regular social event that relieved their feelings of isolation and social disconnection.

Tutor: *It's a social thing for them they can't actually share with anybody else. I think it's just going to have a knock-on effect back to their own families … when you think of, especially where we are, there's a lot of generational unemployment and that's because kids saw their parents not working. (Site 4)*

AEO: *We had a Project Maths group that was helping parents in Project Maths. But they got together, they all bonded as a group, and the tutor was brilliant in the school. But then they did Operation Transformation, all the women did, and then they went out afterwards and had their walking group after their maths … You know, in a community where there was new people moving in, so they wouldn't have known someone. New housing estates and so on. So it was really – that was really positive. (Site 11)*

This sense of connectedness and engagement with others arising from participation in courses was quite striking.

What qualities, skills and knowledge do tutors need to work well in adult numeracy?

Tutors' personal qualities, such as patience, communication skills, and understanding of the previous learning difficulties experienced by adult learners, were regarded as more important than qualifications in mathematics.

ALO: *Patience is a thing that learners would highlight as being one of the things that helps them the most. (Site 6)*

Tutor: *Recognise people's experience in life. And I think to – you know, people say they're no good at maths. I think to be able to recognise where they've used maths in their life. Because they didn't come to age thirty or forty without managing maths you know … recognise their experiential learning. Like what they have to date … because then if you build on that they're not at stage zero at all. (Site 6)*

ALO: *Oh, it's just, it's that they are good with people, they just have to get on (laughing) – I mean I'm not looking, we are not looking for anybody with degrees and everything in maths. (Site 4)*

However, there was evidence that some tutors had inadequate mathematical knowledge, for example, in the use of mathematical language or understanding of mathematical concepts, that could reinforce adult learners' existing difficulties and misconceptions. We consider that tutors do need mathematical knowledge for teaching, where this involves knowledge of students, knowledge of how students learn mathematics, deep understanding of fundamental mathematical concepts, and knowledge of flexible teaching strategies. The most desirable combination

of "skills and attitude" was appropriately captured by this comment:

> ***ALO:*** *Yeah, there are two things, your skills and attitude: if you don't have the attitude the skills are no use. But I've had the good fortune to have somebody who is a trained maths teacher, who her whole degree was about maths from teaching zero, you know Level 1, zero to Level 1 right up, and she was really, really good. (Site 8)*

These needs should be further explored in order to design appropriate professional development for adult numeracy tutors.

Interpretation of Interview Findings in Light of the Literature Review

The review of literature on adult numeracy policy, practice, and research reported in Chapter 1 identified a number of key issues that can be brought to bear on the themes emerging from the interview analysis.

Conceptualisations of numeracy as a technical skill or a social practice

Much of the educational policy literature conceptualises numeracy as a technical skill, thus foregrounding the role of numeracy in enabling individuals to contribute to national economic development while enhancing their personal development and civic participation (Oughton, 2018). Within the interviews conducted for this study, there are certainly echoes of this technicist paradigm. This was evident, firstly, in standalone courses offered to apprentices that allow them to gain the necessary work-related mathematical skills. However, integrated programmes also deliver clear personal development and social benefits to adults whose prior experiences and lack of educational opportunities have left them with unmet numeracy needs. Thus, it would be unwise to dismiss the value of numeracy as a technical skill that can deliver economic and social benefits to previously disenfranchised adults.

Alternatively, numeracy can be conceptualised as a social practice embedded in people's daily lives, in the workplace, at home, at school, and in different cultural and political contexts (Oughton, 2018). This paradigm challenges the privileging of academic forms of numeracy that are typically more visible and powerful than the social practices of numeracy in everyday living. There was some evidence that adult learners in integrated courses were experiencing numeracy as a social practice, for example, when they realised that they were already using mathematics in their lives, or when they gained numeracy knowledge and confidence that enabled them to question authority or take control of their spending.

It appears that adult numeracy programmes offered by Ireland's ETBs are characterised by a pragmatic blend of numeracy paradigms, delivering the complementary benefits of numeracy as a technical skill and a social practice.

Affective responses to numeracy challenges

The research literature on adult numeracy documents the negative emotions and feelings of anxiety, shame, and lack of confidence experienced by adults with unmet numeracy needs (Carpentieri et al., 2010). Affective responses were referred to many times in all the interviews with ETB staff and adult learners, with these references clustering around three themes or areas of activity. The first concerned barriers to adults accessing numeracy programmes: fear, usually arising from previous unpleasant learning experiences at school, was the overriding reason why adults were reluctant to access programmes designed to help them. The second area in which affective responses were significant referenced qualities needed by tutors who work in adult numeracy. Personal qualities, especially empathy and patience, were considered to be essential for addressing the negative emotions that exposure to numeracy situations evoked in adults with unmet numeracy needs. Thus, numeracy programmes and activities need to consider objectives in the affective, as well as the cognitive, domain. The third theme where affective responses were significant was related to the transformative confidence boost experienced by adult learners as the main benefit of participating in a numeracy programme.

Consequences of low levels of performance in numeracy (employment, health, educational attainment, intergenerational effects)

Many research studies have found a strong connection between numeracy skills, employment status, job type and income, and prospects for career advancement (e.g., Parsons & Bynner, 2005). Both ETB staff and adult learners identified unemployment as a consequence of unmet numeracy needs and as motivation for developing the necessary numeracy skills to find a job.

> ***ALO:*** *[…] they're mostly unemployed … out of the labour force or maybe even on a disability or on a CE or dependent spouses. So, you know, you have all of that as well. So they're looking for work but not necessarily wanting to yet because they want to get their skills where they feel that they should be. (Site 8)*

> ***Adult learner:*** *For me personally I would love to work in a clothes shop, I'd love to have the confidence to be able to work on the till to do with money and have the confidence to talk to people and not be nervous and to know what I'm doing. You know, make life a bit better, do something better with my life. (Site 1)*

Poor health has been associated with low levels of numeracy. In particular, adults with unmet numeracy needs have been found to suffer from depression and mental health problems at a higher rate than those with high levels of numeracy (Carpentieri et al., 2010; Parsons & Bynner, 2005). There was evidence of this relationship in the interview data, and expressions of gratitude by adult learners for the mental health benefits offered by the numeracy programmes in which they were participating:

> ***Adult learner:*** *I think one of the best things is […] that we have a whole thing in our day. And you know if we didn't have something like this, just watching telly, or looking at, or watching the radio or … That would drive you cracked. (Site 6)*

Strong links have been reported in the literature between numeracy and educational attainment. For example, the PIAAC (2012) results for Ireland showed that 62.1% of participants who scored at or below Level 1 had completed only primary level education (OECD, 2013a). Likewise, many of the adult learners who were interviewed for the present study shared stories of their own limited schooling:

> ***Adult learner:*** *I went to national, I didn't even do my Leaving Cert, I left then. (Site 8)*

> ***Adult learner:*** *I left school when I was 13 like some of the girls I was left at the back of the class, thought I was stupid. I didn't think I needed an education because I was cleaning all my life but for health reasons, I'm not allowed do that any more, so I came here, they are an absolutely great bunch of people and so are the teachers. (Site 1)*

Some research studies have found a relationship between a parent's numeracy skills and those of their children (Carpentieri et al., 2013). Intergenerational effects of adults' unmet numeracy needs have been identified as reproducing cycles of social and economic inequality in families (NALA, 2019; SOLAS, 2014). On the other hand, efforts to improve adults' numeracy skills could help to break these cycles of disadvantage. In the interview data there were many references to family learning where parents were motivated to improve their numeracy skills so that they could help their children with mathematics homework. There was also evidence that, as a result, adults gained confidence and dignity:

> ***ALO:*** *If they've been belittled in school by teachers or whatever, so that takes time to get over, that thing of self-belief and self-doubt, you know. But if it's to do with their children, again the same thing. They want to feel like they're like the parent, that I do know something in front of the child, you know. (Site 11)*

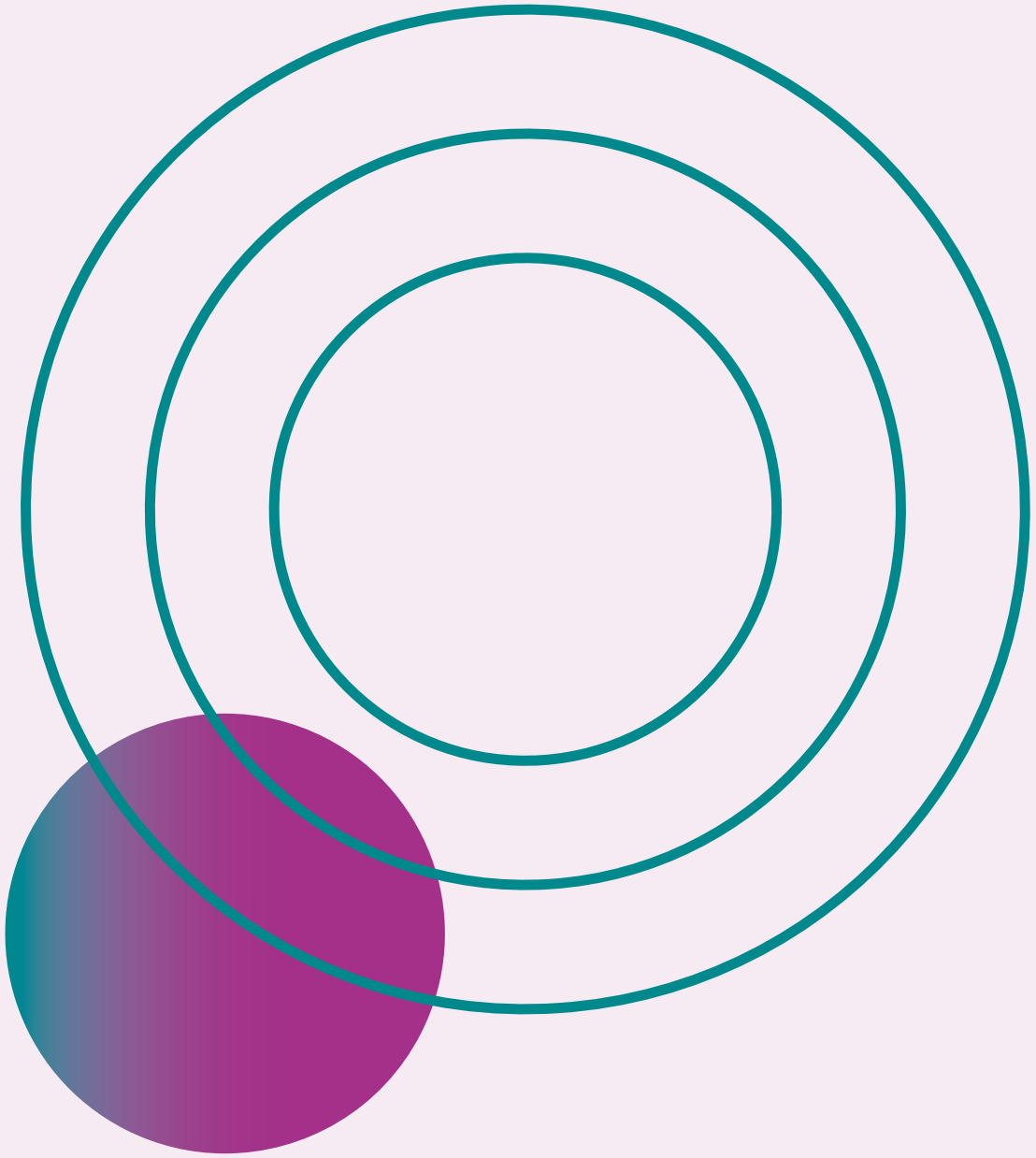
School experiences of learning mathematics

There is strong evidence from the interviews conducted for this study of the damaging effects of adults' prior experience of learning mathematics at school. Schools bear some responsibility for constructing innumeracy in adults because of the canonical teaching approaches adopted by teachers of mathematics (e.g., emphasising memorisation and practice of meaningless skills rather than understanding). The abstract and crowded nature of the school mathematics curriculum, the resultant time pressures involved in covering the curriculum, and the emphasis on assessment via examinations exacerbate this problem for many students. Some adult learners in the interview sample also referred to what they saw as their school teachers' own lack of mathematics knowledge, or these teachers' inability to explain mathematical ideas in ways that students could understand. Equally disturbing were accounts given by these adults of being told by school teachers that they were stupid, or of being left to sit at the back of the classroom.

In contrast to the negative school experiences reported by many adult numeracy learners were the numeracy teaching approaches described by all interview participants. These approaches to delivering adult numeracy activities aimed to build conceptual understanding in real-life contexts, consistent with contemporary research literature in mathematics education. It was also encouraging to see that the teaching approaches reported in the Irish adult numeracy context differed from the procedural and atomistic methods found to be prevalent in adult numeracy programmes delivered in the UK (Coben et al., 2007).

Assessment of numeracy

The introduction of large-scale international testing of adult numeracy (PIAAC), while providing valuable quantitative country-level data on numeracy performance, has highlighted concerns about how to effectively assess adults' numeracy skills at the local level, in authentic everyday contexts. Many adult numeracy teachers in Australia and the UK have been found to resist standardised assessments (Cumming & Gal, 2000) because these methods are unsuitable for gathering evidence of all aspects of numeracy. In the interviews conducted with ETB staff, assessment was discussed only in relation to the initial screening of adult learners to determine their numeracy learning needs. This was usually done informally via conversation and sometimes a short set of written calculation tasks, with care being taken not to embarrass the adult learner or make judgements about their numeracy skills. However, no information was revealed in the interviews as to how adults' numeracy learning was assessed during or at the end of courses. This issue deserves further investigation, and possibly reflects a lack of knowledge and experience amongst ETB staff of how to assess numeracy appropriately, that is, other than by using a written mathematics test. The suggestions made by Cumming and Gal (2000) concerning use of oral reports, group activities, portfolios, and so on, could provide a starting point for tutor CPD in this area.



Chapter 4.
Recommendations

These evidence-based recommendations are intended to further strengthen current practice and extend the many benefits experienced by adult numeracy learners. Adult learners who were interviewed expressed appreciation for the numeracy programmes and the support received from tutors. Tutors were clearly committed, experienced, and sensitive to the specific needs of adult learners. The recommendations are intended to assist the ETBs in building on this strong foundation.

1. Identify and work with a definition of numeracy underpinned by contemporary research

A common understanding of numeracy needs to be developed across the sector, especially in relation to adult numeracy. A single, research-based numeracy framework would support more effective planning and delivery of numeracy programmes, while facilitating communication and promotion of numeracy to the general public. A numeracy framework would need to be integrated with other existing frameworks for curriculum development, assessment, and quality that inform adult literacy and numeracy provision, as outlined in NALA's (2012) Guidelines for Good Adult Literacy Work.

2. Promote the distinctness and importance of numeracy

Numeracy needs to be widely promoted as being distinct from, but related to, the mathematics learned at school. Numeracy is not a subset of literacy; it is a distinct concept with its roots in mathematics. Numeracy is embedded in everyday life – in the home, at work, and in community settings. Numeracy is "everywhere", and most people are more adept at using mathematics in their everyday lives than they realise.

3. Provide adequate resourcing for coordination and delivery of adult numeracy programmes

None of the ETBs that participated in the survey research had appointed a numeracy coordinator, and none reported a separate numeracy budget. Given the large number of adult numeracy courses offered across the sector, the serious and varied consequences of unmet numeracy needs amongst the adult population, and the low levels of numeracy of Irish adults identified by the most recent PIAAC results, there is a need for greater emphasis to be placed on separate coordination and budgeting for adult numeracy programmes.

4. Recognise the numeracy demands and numeracy learning opportunities of all ETB courses

Since numeracy is embedded in everyday life, provision for adult numeracy should be integrated into all ETB programmes and not only those labelled as numeracy. This means that all adult education tutors need to be able to recognise the numeracy demands and opportunities in the courses they teach.

5. Establish clear and agreed ways to measure and track success at the local level

Accreditation serves many useful purposes, and adults who are awarded a certificate at the end of a course often experience great pride and satisfaction at this achievement. However, there was a consensus amongst ETB staff that emphasis on accreditation should be balanced with learner goals and that learner ambitions be honoured at all times (whether those ambitions are for certification or otherwise).

6. Develop a wider range of numeracy assessment approaches

SOLAS/ETBI have published good practice guidelines on initial and ongoing assessment of literacy and numeracy in ETBs (SOLAS, 2018a). Such approaches to initial and ongoing assessment help to determine learner skill levels and needs. As stated in the ETBI/SOLAS guidelines, there is value in ETBs expanding the numeracy assessment repertoire used in initial screening over time, and continuing to use a wide range of numeracy assessment approaches to collect evidence of adult learners' progress.

7. Support tutors in finding, evaluating, and adapting resources for adult numeracy

A number of ETBI/SOLAS/NALA reports call for a central repository of resources for adult literacy, numeracy and language. However, collections of online resources already exist – for example, the *ETBI FET Digital Library* at https://library.etbi.ie/home. and the NALA Tutors Information Hub available at https://www.nala.ie/tutors/. Thus, greater attention should be given to promoting and sharing these resources, while supporting tutors to select, evaluate, and adapt resources to suit their learners' needs. Good-quality adult numeracy resources can also be adapted from existing materials designed for younger learners. All resources should be accompanied by guidelines showing tutors how to modify them to suit their learners' needs and interests. Development of resources should be informed by the common numeracy framework referred to in Recommendation 1. A professional development programme should be designed and delivered to complement these resources and adaptation guidelines.

8. Ensure adult numeracy tutors are appropriately qualified

Adult numeracy tutors need personal qualities such as patience, empathy, and good communication skills. They also need to have adequate mathematical knowledge for teaching, comprising knowledge of adult learners' abilities and needs, knowledge of how people learn mathematics, deep understanding of fundamental mathematical concepts, knowledge of flexible teaching strategies, and the ability to "see" numeracy in the world around them.

9. Provide numeracy-specific professional development

Providing professional development for adult numeracy tutors was identified as a pressing need by interviewees participating in this study. Professional development needs to be widely promoted and accessible to tutors, and this could be done by offering regional workshops and informal meetings in different locations throughout the country as well as via online webinars. The professional development may involve tutors in sharing their practice as well as learning new teaching approaches. Professional development should be coordinated with the aim of establishing communities of practice across the ETBs while raising the profile of adult numeracy provision.

Chapter 5.
Guidelines for Good Numeracy Practice

The proposed good practice guidelines are informed by four sources:

1. a review of national and international policy and practice literature on adult numeracy;
2. conclusions drawn from analysis of surveys of 16 ETBs;
3. conclusions drawn from analysis of interviews with AEOs, ALOs, adult numeracy tutors, and adult learners in the 16 ETBs; and
4. ETB staff members' responses to an interview question about what should be included in good practice guidelines.

The guidelines are not intended to prescribe what ETBs "must" do. Instead, they set out broad standards for good practice in adult numeracy that invite reflection, discussion, and interpretation in light of local needs, contexts, and resourcing. The guidelines also aim to build on the ETBs' existing good practice in adult education, in particular the strong learner-centred ethos and adult learning approaches that value relevant content, situational and experiential learning, and adult learners' input into planning and evaluation of their learning. The guidelines are illustrated with examples of good practice, presented in numbered boxes. Some of these examples come from interviews with adult numeracy tutors, while others are drawn from the research and professional literature on mathematics and numeracy education. Thus, the guidelines give voice to adult numeracy tutors while proposing research-informed practices for consideration by ETBs. It is useful to read these guidelines in conjunction with the Guidelines for Good Adult Literacy Practice (NALA, 2012) as they complement each other.

1. Taking time to think about numeracy

Guideline 1.1 Agree on a definition of numeracy that meets contemporary needs

Our understanding of numeracy has changed over time, going from a type of quantitative numeracy to the later conception of accessing, interpreting and using mathematical concepts for a wide variety of life activities. Current thinking on numeracy points to the need to to account for contemporary understandings of adult numeracy by giving more attention to:

- dispositions to use mathematics;
- the ability to see mathematics in a numeracy situation;
- critical reflection and action;
- the degree of accuracy required to solve numeracy problems in context; and
- digital and technological representations and tools (Tout et al., 2017).

All of these contemporary refinements to the meaning of adult numeracy should be considered by ETBs when thinking about learners' needs and planning adult numeracy programmes.

There are different ideological perspectives on numeracy.

A practical approach to adult numeracy provision will acknowledge different ideological perspectives on numeracy.

On the one hand, large-scale international surveys like PIAAC tend to view numeracy as a technical skill that enables individuals to contribute to a nation's economic development and global competitiveness. A possible consequence of this perspective is that people assessed as having low levels of numeracy may be at risk of having this assessment of their skills extended across other aspects of their abilities also.

An alternative view is of numeracy as a social practice "embedded in people's lives as they interact with the social world at home, work, school or in the community".

A social practice perspective takes into account cultural and contextual factors that influence the informal ways in which numeracy is practised, which often differ from how calculations are taught in the mathematics classroom. However, a potential drawback associated with the social practice perspective is that it may overlook the need for adults to master the formal numeracy practices required for career progression or further study.

Given the wide range of goals that motivate adults to participate in numeracy programmes, consideration needs to be given to striking a balance between the technical skills perspective and the social practice

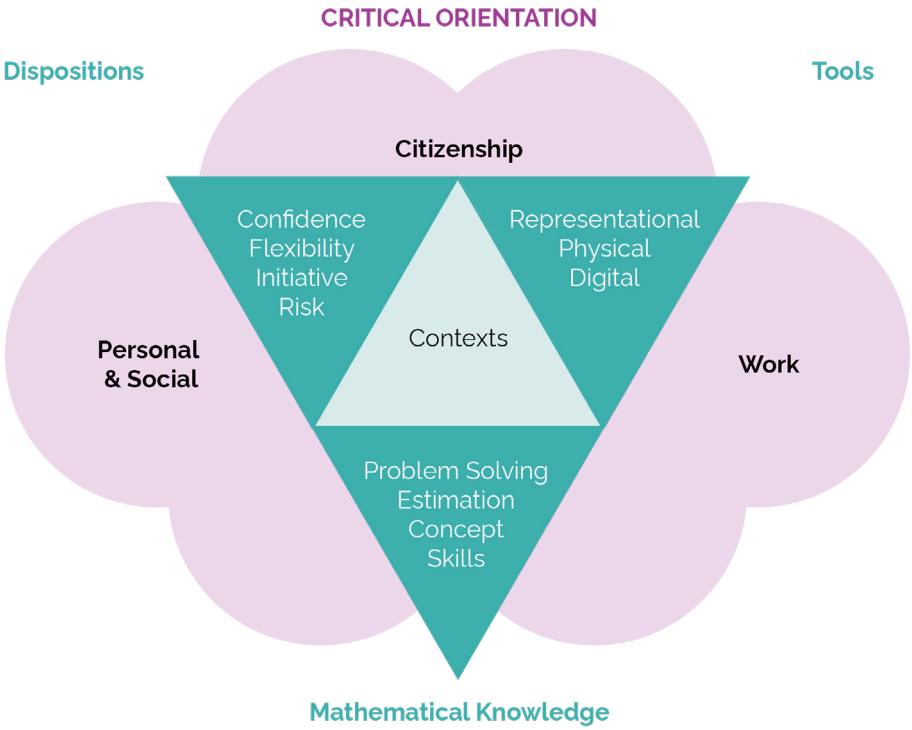


Figure 19. A model for numeracy in the 21st century (Goos et al., 2014).

perspective when planning for adult numeracy provision. The philosophy of adult numeracy practice draws on a number of theories and approaches, which are further detailed in the Guidelines for Good Adult Literacy Practice (NALA, 2012).

Guideline 1.2 Go deep and wide with application of numeracy

In an increasingly complex and information-drenched society, numerate citizens need to decide how to evaluate quantitative, spatial or probabilistic information used to support claims made in the media or other contexts. They also need to recognise how mathematical information and practices can be used to help develop opinions about social or political issues.

Informed and critical citizens need to be numerate citizens. Almost every public issue depends on data, projections, and the kind of systematic thinking that is at the heart of numeracy. Different curriculum contexts within adult education programmes also have distinctive numeracy demands, so that adult learners need to become numerate across the range of contexts in which their learning takes place (Quantitative Literacy Design Team, 2001).

Numeracy in the 21st century involves critical thinking, working with representations and tools, and applying mathematical knowledge confidently in a range of contexts.

The 21st-century numeracy model identifies *five domains* contributing to numerate behaviour.

Access to mathematical knowledge is a human right that develops the knowledge, skills and understanding to become educated citizens. This includes concepts, skills, problem solving strategies and the ability to make sensible estimations.

1. ***Positive dispositions*** – confidence in ability, willingness to engage with individual and collaborative tasks, and to apply knowledge flexibly and adaptively.
2. ***Using symbolic tools***. Sfard and McClain (2002) discuss ways in which symbolic tools and other specially designed artefacts enable, mediate, and shape mathematical thinking (p. 154). Tools may be representational (symbol systems, graphs, maps, diagrams, drawings, tables, ready reckoners), physical (models, measuring instruments), and digital (computers, software, calculators and internet).
3. ***Contexts*** (Quantitative Literacy Design Team, 2001) – organise finances, make decisions affecting personal health, engage in leisure activities that require numeracy knowledge.
4. ***Critical orientation*** – evaluate the reasonableness of results , awareness of appropriate and inappropriate uses of mathematical thinking, analyse situations, draw conclusions.

The 21st-century numeracy model offers many opportunities for tutors and adult learners to explore the numeracy demands of diverse social situations, family and community events, and workplace activities.

The research informing these guidelines highlights the need for a dynamic and contemporary understanding of adult numeracy. The numeracy model shown in Figure 19 was recommended by the review of the PIAAC adult numeracy framework as an effective way of describing adults' numerate behaviour in the 21st century. The model is designed to support teachers and tutors as a framework for planning numeracy tasks and programmes and for reflecting on learners' needs (Goos et al., 2014).

2. Placing the learner at the centre

Guideline 2.1 Define success with the learner

In line with the good practice guidelines (NALA, 2012), adult learners should be consulted about appropriate ways of measuring their success in numeracy learning. These might take into account changes in numeracy knowledge and skills, as well as dispositional changes in confidence and perseverance. Standardised tests and other written tasks that only reward correct answers will not uncover all the valuable knowledge, skills, and dispositions that an adult learner may possess. Instead, a wide range of approaches – especially informal approaches – can be used.

There are different ways to recognise achievement.

ETBs may consider that accreditation is not the highest priority for adult numeracy learners who are more interested in developing practical life skills than in obtaining a certificate. However, accreditation can serve many useful purposes and adults who are awarded a certificate at the end of a course often experience great pride and satisfaction at this achievement.

Guideline 2.2 Acknowledge long-held sensitivities around numeracy

Adult numeracy learners have diverse goals and experience diverse benefits from their participation in numeracy programmes.

Learner-centred adult numeracy delivery acknowledges adults' diverse goals and needs.

An adult learning ethos, emphasising experiential relevance, learner-centredness, and collaborative planning that involves adults in their learning, is central to the work of ETBs.

Many adults had negative experiences of learning mathematics at school. **In the context of adult numeracy provision, tutors and ETB staff also need to be sensitive to the possibly damaging effects on adults of their school mathematics learning experiences. These experiences have often led adults to feel anxiety, fear, shame, and lack of confidence in their mathematical abilities. Many adults can remember the point at which mathematics stopped making sense at school, and how their reluctance to ask questions of the teacher only reinforced their self-perception of low ability. Creating a comfortable and safe learning environment is therefore especially important when working with adults who have developed a view of mathematics as involving memorisation of facts, formulas, and procedures, and whose experiences of learning mathematics have too often led them to be judged harshly for not getting the "right" answer (See Box 1).**

Box 1
I did a class one time with the group and I was doing adding and subtraction. So just pure adding and subtraction. I was just – they couldn't do it. but I put a euro sign in front of it and they could do it so fast. So it was really a learning moment for me, you know! And they could do huge sums in their head once the euro sign's there. But just pure numbers – I could be just doing [versions] or something. It absolutely – so relevance is so important, you know. **(Adult numeracy tutor)**

Guideline 2.3 Help the learner recognise and value their prior skill and knowledge

Adult learners often reinforce their self-perceptions of low levels of numeracy skills by dismissing their own numerate behaviour as mere "common sense" or as something that does not involve mathematics at all. There are opportunities here for tutors to recognise and value adults' informal, and often invisible, numeracy practices. These practices can then be discussed and related to the more formal approaches used in the school mathematics classroom.

Guideline 2.4 Honour learner ambitions

While many adults are seeking to develop the numeracy knowledge and skills needed for specific trades and jobs, others are motivated by a desire to help their children learn mathematics, to be able to make financial decisions and manage their household budget, and especially to overcome their fear of mathematics (See Box 2).

Box 2
I was recently working with a guy who is – he wants – he was in the job and then he gives it up but he wants to go back to being a van driver. But he stopped because he felt really intimidated about the delivery addresses. And he didn't know about Google Maps. So he came in, actually through Turas Nua as well, he came and I showed him on Google Maps that if you put in the code, the Eircode, that it actually will talk you. The address is on the package and you put that into Google Maps. You have it there. It's a matter of transcribing it onto the app. It will take you from where you are to where you need to go. It was life-changing for him. So his tutor now is actually going to be working with him on that. And that's very much maths, it's very much integrated with literacy, and it's very much going to be a new lease of life for

him. It was like a gift given to him. He didn't know that it exists. **(Adult numeracy tutor)**

ETB staff might look to the 21st-century numeracy model to acknowledge and celebrate the variety of benefits experienced by adults who participate in numeracy programmes. These benefits are likely to include not only improved mathematical knowledge, but also higher levels of confidence (dispositions) in dealing with the demands of everyday life (contexts), including use of digital technologies (tools), and in asking questions or challenging authority (critical orientation). In addition, many adult numeracy learners speak of the enjoyment and mental health benefits they experience in attending classes as a regular social event that relieves their feelings of isolation and social disconnection.

3. Designing and delivering adult numeracy programmes

Guideline 3.1 Be alert and responsive to varying degree of unmet numeracy need

Adult numeracy courses may be standalone or integrated

Each ETB will offer a menu of courses, depending on the resources available to them and the needs of the adult numeracy learners with whom they work. These may range from standalone courses designed for teaching apprentices the mathematics relevant to their trade, to integrated courses that teach numeracy knowledge and skills within everyday contexts that are immediately relevant to the adult participants.

Many adults are reluctant to admit their numeracy learning needs, and instead approach an ETB looking for courses in areas other than numeracy. However, once these adult participants develop confidence and comfort in the learning environment of the ETB, tutors and ETB staff can be alert to opportunities for identifying their numeracy learning needs and directing them into integrated courses with a numeracy focus (See Box 3).

Box 3
I suppose in terms of integrating the maths into kind of everyday classes, things like even if it's a literacy class, doing the dates and writing it in words but also writing it in numbers. Yesterday I had an example where we were looking at signs and symbols and finding the numbers in it. And one of them was 8 degrees Celsius and one of the learners knew that there was an 8 and there was a picture of a sun and a cloud but had no idea what the little circle and the 'C' was about. It was a whole new revelation. So it's kind of, again bringing in your everyday maths. So we looked at the weather forecast on my phone and looked at different degrees Celsius. And it was just a small thing but it had a huge impact. So it's just those kinds of integrating it, even if it's not necessarily a numeracy class, that there's numbers in everything, isn't there. **(Adult numeracy tutor)**

Adult education courses have specific numeracy demands and offer numeracy learning opportunities

Guideline 3.2 Clearly define and communicate the numeracy demands of programmes

Whether or not they are labelled as a "numeracy" course, many of the courses offered by an ETB will have specific numeracy demands. For example, a course on developing IT skills can introduce spreadsheets as an efficient way of calculating, finding averages, or working out percentages; while a course on gardening is a natural context for learning about measurement (length, perimeter, area, volume) and shapes (different-shaped garden beds). Both these examples also involve using different kinds of tools, such as computer software (digital tool), measuring instruments (physical tool), or diagrams drawn to scale (representational tool). Adult numeracy practitioners need to be aware of the numeracy demands of the courses they teach, and to be able to work with colleagues who teach other courses to capitalise on the numeracy learning opportunities within these courses. (See Boxes 4 and 5 for examples.) The 21st-century numeracy model can be used as a framework for auditing the numeracy demands of courses (as described in Chapter 4 of Goos et al., 2019). This process would also be greatly aided by reference to the Integrating Literacy Guidelines for FET Centres (2013).

Box 4
Basically integration of IT skills with numeracy or just everyday functions I'm talking about. a party. They have a child's party, you know, and then like what are the items you need? So we use an Excel spreadsheet. how many people responded? Adding, subtracting, give them a budget, that kind of thing. that has worked well. You're integrating your communications, your literacy, your IT skills, and your computer skills together. but what I think, if you just isolate maths on its own it doesn't work. **(Adult numeracy tutor)**

Box 5
On pancake day, I gave a talk on making pancakes … I was putting together the ingredients and the recipe for making pancakes. And I'd a flipchart there, but I was doing it, I was showing how maths is relevant in all of this. That your quantity of eggs, your grams of flour, your litres of milk. All the different types of measurements you use and the vocabulary around it that's maths related, without us even thinking about it. The temperature the pan was heated up then the amount of time. And even the thickness of the batter, what volume of liquid should you pour and all this jargon was going on. While at the same time Level 3 spreadsheets class here, were using that to create a spreadsheet. And they had all the different cells with the rows and columns of

quantities and how the numbers could change if you wanted more batter. You could make enough for eight people, or sixteen people, or twenty four people. **(Adult numeracy tutor)**

Guideline 3.3 Offer context-rich and meaningful numeracy

Good adult numeracy practice draws on contexts that are meaningful to adults

Numeracy activities should draw on meaningful contexts, build mathematical understanding, and make connections between different areas of mathematics and between mathematics and the real world. Preparing learning materials: A guide for literacy and numeracy tutors (NALA, 2006) is a useful resource in that regard.

Effective adult numeracy tutors are adept at identifying their learners' interests and needs and using these as meaningful contexts for numeracy development (See Boxes 6 and 7 for examples).

Box 6
I was just thinking of a group of men I had one time and they wanted to know – we were doing shapes, in particular. And what worked really well was I actually brought in a cornflakes box. Because they find it difficult to, I suppose, to tell the difference in volume and flat shapes or 2-D and 3-D shapes. You know, so actually bringing in everyday things that they could relate to. and they actually made the shapes because they were hands-on, you know, practical. **(Adult numeracy tutor)**

Box 7
One course in particular that I just ran it's called maths through darts. We decided to do data handling level 2. But I was using the dart board as my resource for adding and subtracting initially. And then and all of that goes with that place, value, the renaming method. And also we're following the rules of addition and subtraction. But we were also then enjoying having fun with the game. Then creating our own experiments and creating our own data that met the learning outcomes. So there's a mixture. The input of the students was huge in all this, the fun element. The level 2 data handling was more freedom. To meet learning outcomes through that method that I decided to use the dartboard as the main resource. Along with other activities such as price comparisons, going onto the Argos website and seeing how much certain sets of darts cost, or certain quality of dartboards, etc. So the whole theme of that one game could be met through, but there was a lot of thinking involved at the beginning to make this work you know. But the learners enjoyed it. They're all taking turns; they're throwing fifty darts randomly at the board. And I'm keeping track of where those darts are landing. And we're tallying. There's a tally sheet, there's a table, there's a bar chart being created. **(Adult numeracy tutor)**

Guideline 3.4 Ensure concepts are understood and applied

Good adult numeracy practice develops conceptual understanding of mathematics

Good numeracy teaching practice develops conceptual understanding as well as knowledge of facts and proficiency with calculation skills. Four important aspects of understanding should be emphasised (Goos, Vale, & Stillman, 2016):

1. Understanding as making connections

How does this fit with what you already know?

How is this topic/problem like things you have learned before?

How is the work we have done today (on …) related to work we did last week/last session (on …)?

2. Understanding as applying familiar knowledge in new contexts

The new context may be mathematical (e.g., using fractions and percentages to represent probability), another adult education course, (e.g., recording and analysing data in a spreadsheet), or in the real world (e.g., using formulas for perimeter and area to design a garden).

3. Understanding as translating between representations

Using a fraction wall, number line, pieces of a rectangle, sectors of a circle to represent fractions;

Using Excel to convert a table of values into a graph;

Drawing a diagram to represent a word problem.

4. Understanding as explaining mathematical thinking

Learners of all ages find thatexplaining their thinking tosomeone else helps their ownunderstanding.

Guideline 3.5 Select, adapt, and create adult numeracy learning resources

Adult numeracy resources are embedded in real-life contexts

Adult numeracy practitioners will develop resources embedded in real-life contexts to suit learners' needs (see Box 8). Resources are also available through the Tutors information hub on NALA's website.

Box 8
So I'm currently doing something on invoices, actually, with a group, and how the invoice is worked out. So you would imagine certain people would know how to do it. No. How to do a trade discount of it, how to put the VAT on, and what you have to do in each step. So a bit of confusion around that at the moment. So I was asking them to get the invoices. And even to find out the different types of tax. So it might be an exercise to go off, look up Revenue, look up Citizens Information. We have different tax rates. Even if you look at the Lidl or the Aldi receipt and you see that like certain goods are charged at different percentage rates – so that kind of stuff is bringing in the relevance. **(Adult numeracy tutor)**

Numeracy resources designed for young learners can be adapted to suit adults.

Many tutors find that existing numeracy resources have been designed for children and are therefore not suitable for adults. However, these resources can often be adapted for older learners. A rich and balanced mathematics learning activity or resource has some or all of the following features (Lovitt & Clarke, 2011):

- It draws on a range of important mathematical content;
- It is engaging for learners;
- All learners are able to make a start, as it caters for a range of levels of understanding;
- It can be successfully undertaken using a range of methods or approaches;
- It provides a measure of choice or openness, leading to a sense of learner ownership;
- It involves learners actively in their own learning;
- It shows the way in which mathematics can help to make sense of the world;
- It makes appropriate and effective use of technology;
- It allows learners to show connections they are able to make between the concepts they have learned;
- It draws the attention of learners to important aspects of mathematical activity; and
- It helps teachers to decide what specific help learners may require in the relevant content areas, or ways in which learners might be extended.

Both Curriculum Development – an Evolving Model for Adult Literacy and Numeracy Education (NALA, 2009a) and Curriculum Development in Intensive Tuition in Adult Basic Education (NALA, 2009b) aim to also support tutors working across a range of settings and a diverse range of learners.

Guideline 3.6. Draw on good practice guidelines when assessing numeracy

ETBs will develop local criteria for success in their adult numeracy programmes.

Assessment can be informal and contextualised and follow the already established good practice guidelines published by SOLAS and ETBI, as well as NALA (2012).

Cumming and Gal (2000) and SOLAS/ETBI provide valuable insights on what constitutes valid, reliable and learner-centred approaches to assessment.

Guideline 3.7 Evaluate courses for effectiveness

Adult numeracy tutors use flexible planning to design activities and courses to meet adult learners' needs. However, there is value in articulating the overall purpose of a numeracy course and then evaluating the extent to which that purpose has been met as well as any other unanticipated outcomes. In other words, evaluation seeks to answer questions such as "Did that work?" and "Could it work better?" Evaluation should engage and seek input from all stakeholders, clients, collaborators, and partners (see Dent et al., 2014, for a useful evaluation toolkit).

Evaluation looks at what happens as the result of a programme. A framework for thinking about the impact of a programme is the four-level model developed by Kilpatrick (1994).

- Level 1 (Reaction): How do the participants feel about their experience?
- Level 2 (Learning): How have participants' knowledge and skills increased?
- Level 3 (Behaviour): How do participants apply their learning and how does this result in personal change?
- Level 4 (Results): How does the programme impact on organisational or societal factors? (i.e. How does it impact on this ETB?)

As well as observing adult learners' reactions to the programmes in which they are involved and documenting changes in their knowledge and skills, an evaluation might make use of data on adult learners' backgrounds and their engagement and progression as measures of success. This assertion is supported by a recent research collaboration between SOLAS, NALA and Maynooth University which documented contemporary evidence of the effectiveness of family literacy activities in engaging adult learners and contributing to the raising of literacy skills levels across generations: "Mental health and well-being are…enhanced by participation in adult learning. Many

Cumming and Gal (2000)	Good Practice Guidelines in Initial and Ongoing Assessment of Literacy and Numeracy
1. Both instruction and assessment of adult numeracy skills should be informed by broad definitions of numeracy to encompass the work and life mathematical experiences and strategies adults already have.	"Literacy", "numeracy", and "assessment" are complex concepts that can be understood in different ways by different people, depending on the situation and the purpose. Numeracy is the ability to access, use, interpret, and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life.
2. Ideally, assessment should address reasoning processes and (mathematical) problem solving, conceptual knowledge and computation, and the ability to interpret and critically react to quantitative and statistical information embedded in print or media messages, as well as examine transfer of mathematical problem solving across life and work contexts.	Recording of assessment results refers to technical knowledge and skill *and also*, to the relevant broader dimensions of application and competence.
3. Assessment should be directed by the instructional focus and goals of the programme, not vice versa.	Based on the individual's knowledge, skills, goals and aspirations; any dimension of literacy or numeracy the person needs in order to achieve their goal should be assessed.
4. One type of assessment alone (e.g., use of standardised tests) will not be sufficient to inform all assessment or evaluation requirements of learners or a programme.	Where possible, resources make use of authentic tasks, situations and materials.
5. Convenient and apparently simple assessments such as standardised tests may not be appropriate and informative and may do a disservice to students, teachers, and a programme.	
6. Adult numeracy assessment should encompass the range of assessment forms being used in other educational settings and may include oral reports, group activities, portfolios, and so forth.	Resources are selected to be consistent with the learner's goals and specific learning objectives.
7. Adult numeracy assessment should recognise that adult learners may perform at quite different levels in oral mathematical discussions from how they perform on written tasks.	Materials are aligned to literacy and numeracy Levels 1, 2, 3 on the NFQ/QQI framework. For more complex activities, sub-skills and specific dimensions may be at different levels.
8. Assessment indicators for workplace programmes are most appropriately drawn from a task analysis of work.	Initial and ongoing assessment of adult literacy and numeracy is carried out using the *performance task* method of assessment.
9. Assessment should inform students in a systematic way of their progress in, and achievement from, a programme.	The assessment process generates a profile, mark, level or grade, but not reading or spelling ages.
10. Only appropriate interpretation and use should be made of assessment information; adult numeracy practitioners need to be aware of cultural difficulties in planning and interpreting assessment. (pp.328-329)	Recording of assessment results refers to technical knowledge and skill *and also*, to the relevant broader dimensions of application and competence. Recording of assessment results refers to specific learning goals which allow for ease of monitoring progress over time.

of the positive contributions of family literacy merit closer scrutiny, and research on, and evaluation of, new structures will be helped by better data collection and clearer organisational structures."[6]

4. Supporting and developing adult numeracy tutors

Guideline 4.1 Plan for adult numeracy tutors' professional development

Although most ETBs have training available for their adult numeracy tutors, a large majority believe there is unmet demand in this area. Tutors themselves are looking for more opportunities to participate in formal professional development activities and programmes.

NALA (2015) has developed a framework for meeting the professional development needs of tutors of adult numeracy in the Irish Further Education and Training sector. This framework recognises that tutors are adult learners in the context of professional development. It recommends that professional development should be underpinned by a broad and dynamic view of numeracy that is internationally recognised. The framework also identifies important qualities and knowledge that adult numeracy tutors need to possess, including excellent understanding of elementary mathematics; digital literacy skills; understanding of programme design, development and assessment; and "mathematical eyes", or a view of mathematics as part of everyday life.

ETBs should consider ways of supporting adult numeracy tutors to develop these qualities, and of making such opportunities accessible to tutors in their local area while avoiding costs to tutors in terms of time and financial commitment.

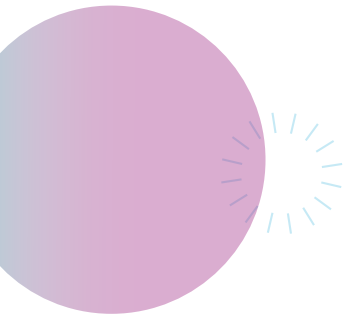
Guideline 4.2 Create networking opportunities for adult numeracy tutors

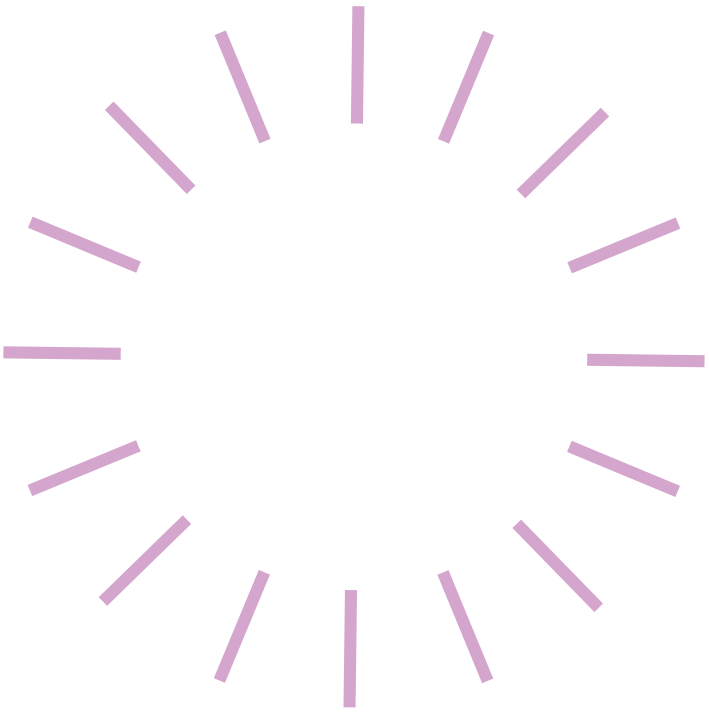
Most adult numeracy tutors work part-time or are volunteers, and as a result can feel isolated from peers in their own or other ETB locations. Tutors have expressed a desire for face-to-face and online networking opportunities that bring them together with colleagues for discussion and demonstration of different teaching materials and approaches to suit various types of adult learners, and for sharing of information about how numeracy is integrated into other courses such as horticulture or hospitality. Such meetings could help establish communities of practice across the ETBs while raising the community profile of adult numeracy provision.

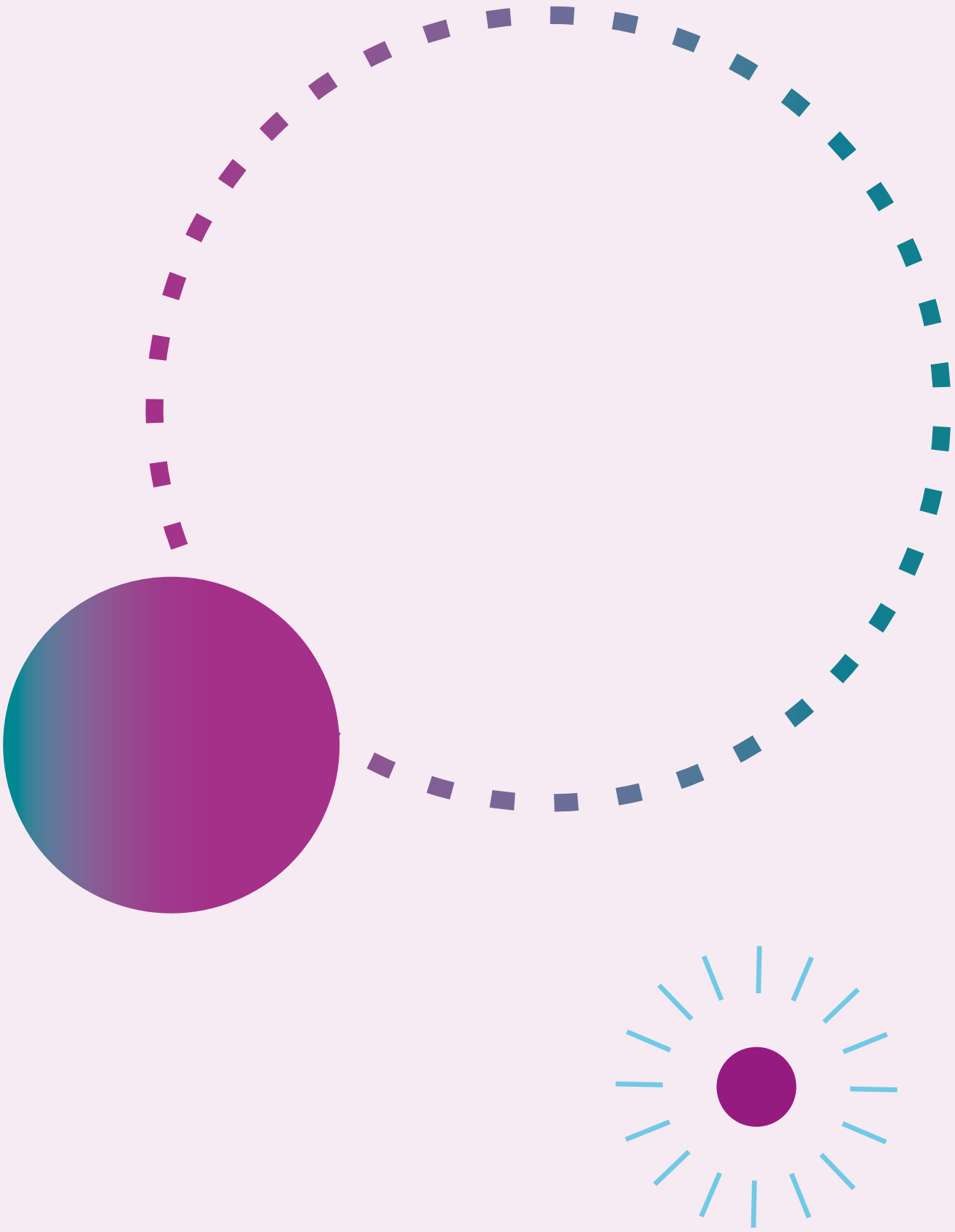
Conclusion

The meaning of numeracy has changed over time, just as the numeracy demands of life and work in the 21st century are constantly changing. Adult numeracy provision should be responsive to these dynamic conditions while taking account of adult learners' needs and interests. Clearly, numeracy involves mathematical knowledge and understanding, but a numerate person is also confident in their own mathematical ability and able to "see" when it makes sense to use mathematics in everyday situations. Adult numeracy tutors are adept at designing context-rich numeracy experiences that build learners' confidence and competence. This work now needs to be recognised and supported on a national level, for example, by developing a practitioner toolkit that integrates these research-informed guidelines with more examples of good adult numeracy practice. Such an initiative might lead to the establishment of a national adult numeracy learning community to support practitioners in sharing resources and local good practice.

6 SOLAS, NALA, ETBI 2020. Enabling Intergenerational Learning: Background Report on Family Literacy Practices in Irish Education and Training Boards (ETBs), p105





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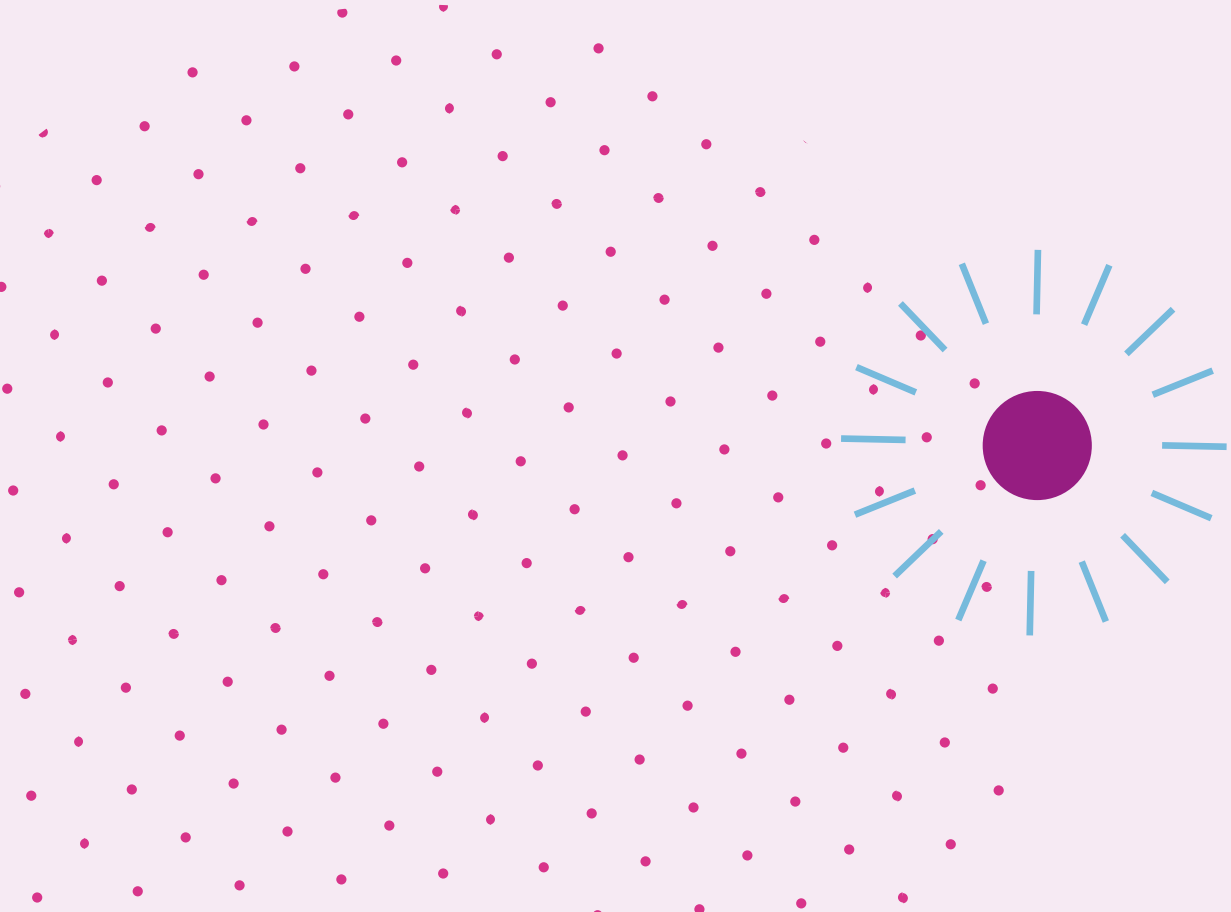


Appendix 1.
Survey Instrument

SOLAS Adult Numeracy Survey

Survey of adult numeracy provision in ETBs

Thank you for taking the time to complete this questionnaire. It is part of a wider study that aims to map current provision of adult numeracy in Ireland and to capture evidence of good practice. You will have the chance to clarify and expand on the detail collected here when we carry out in depth interviews/focus groups in the different ETB areas. We want to provide data about the range, delivery and outcomes of adult numeracy interventions with a view to informing future adult numeracy strategies.

Our focus is on numeracy teaching and learning with a view to increasing the skills base of adults. We expect therefore that activities where the numeracy element may be integrated or embedded in a wider learning opportunity will also be part of your responses here. For example a Horticultural course is not necessarily delivered with an adult numeracy approach. If the Horticultural course aims to extend the adults' learning of numeracy and how to use these new horticultural skills and knowledge in a numeracy situation, then it comes within our area of interest.

Answers relate to the whole ETB area.

The detail in this questionnaire refers to the year 2018 – in other words the last full calendar year of family literacy provision. It should correspond to the data returned to SOLAS in your annual return for 2018.

We hope the questions are all clear but if you have any queries you can contact Tina Byrne at tbyrne@nala.ie or 014127917

We will be happy to answer any questions.

1. ETB details

Name of ETB

AEO email

AEO phone

Adult numeracy coordinator (if different from AEO) email

Adult numeracy coordinator phone

2. What was the total number of adult literacy learners in your ETB in 2018?

3. What percentage of the total number attended standalone numeracy tuition?

4. What percentage of the total number attended embedded or integrated numeracy tuition?

5. How many hours of adult numeracy are there in your ETB area per week?

6. How many paid tutor hours went into adult numeracy in 2018?

7. How many paid tutor hours went into standalone adult numeracy in 2018?

8. How many numeracy coordination hours were paid in 2018?

9. Is there a separate coordinator for adult numeracy in your ETB?

10. Does supply of adult numeracy courses meet demand?

Yes No

11. If no, what additional resources are needed to run more adult numeracy activities?

12. How many adult numeracy courses were run in 2018?

13. How many standalone adult numeracy courses were run in 2018?

14. How many integrated adult numeracy courses were run in 2018?

15. What was the ETB budget for adult literacy in 2018?

16. Is adult numeracy a distinct budget heading in your ETB?

Yes No

17. What was the adult numeracy budget for 2018?

18. What funders, apart from the ETB, did you use for adult numeracy?

SOLAS Adult Numeracy Survey
Programme type and duration

19. Which of the following adult numeracy opportunities do you provide? (please tick as appropriate)

- Standalone numeracy programmes
- Adult numeracy learning group
- Doing numeracy as part of an adult literacy class
- Adult numeracy to support workplace tasks
- Adult numeracy to support budgeting and money matters
- Adult numeracy to support or enhance digital or technical numeracy
- Adult numeracy to support pre-school children's maths
- Adult numeracy to support primary children's maths
- Adult numeracy to support secondary children's maths
- Other (please specify)

20. How many hours of adult numeracy provision did you have in 2018?

21. How many hours of standalone adult numeracy provision did you have in 2018?

22. How many hours of integrated adult numeracy provision did you have in 2018?

23. How long, on average, does a numeracy course last?

24. Do you organise one off adult numeracy activities?

Yes No

If yes, please specify

25. What level of adult numeracy/mathematics do you currently offer? (please tick as appropriate)

- QQI Mathematics level 1
- QQI Mathematics level 2
- QQI Mathematics level 3
- QQI Mathematics level 4
- Customised programmes through adult literacy service

- [ ] Non accredited programmes through adult literacy service
- [ ] Junior Certificate Foundation
- [ ] Junior Certificate Ordinary
- [ ] Junior Certificate Higher
- [ ] Leaving Certificate Foundation
- [ ] Leaving Certificate Ordinary
- [ ] Leaving Certificate Higher
- [ ] Vocational numeracy (Agriculture, Catering, Fishing etc)
- [ ] Other (please specify)

26. By which of the following methods are adult learners recruited or referred? (please tick as appropriate)

- [ ] Through advertised programme of adult learning activities
- [ ] Referral from an ALO
- [ ] Self referral
- [ ] Through local community centre
- [ ] Through Intreo/local employment service
- [ ] Through health nurse or social worker
- [ ] Through local library
- [ ] Through HSCL/DEIS school
- [ ] Through NALA telephone helpline
- [ ] By word of mouth
- [ ] Other (please specify)

SOLAS Adult Numeracy Survey
Programme outcomes

27. Have you gathered quantitative evidence of the following outcomes from adult numeracy activities? (please tick as appropriate)

- [ ] Adult progress into other learning
- [ ] Adults progress into other employment
- [ ] Adults become more confident about their numeracy abilities
- [ ] Adults become more confident about budgeting and money matters
- [ ] Adults become more confident about managing their personal finances

- [ ] Adult become more confident in dealings with financial institutions, for example, local bank, post office or credit union
- [ ] Adults become more confident about helping children with schoolwork/homework
- [ ] Adults become more confident about using technology including the use of mobile phones

How is this information gathered? (please specify)

28. Have you anecdotal evidence of the following outcomes from adult numeracy activities? (please tick as appropriate)

- [ ] Adult progress into other learning
- [ ] Adults progress into other employment
- [ ] Adults become more confident about their numeracy abilities
- [ ] Adults become more confident about budgeting and money matters
- [ ] Adults become more confident about managing their personal finances
- [ ] Adult become more confident in dealings with financial institutions, for example, local bank, post office or credit union
- [ ] Adults become more confident about helping children with schoolwork/homework
- [ ] Adults become more confident about using technology including the use of mobile phones

How is this information gathered? (please specify)

29. Are numeracy courses accredited?

Yes [ ] No [ ]

If yes, at what QQI level

30. Is initial assessment a part of adult numeracy?

Yes [ ] No [ ]

If yes, who carries out the assessment

31. Is summative assessment a part of adult numeracy?

Yes [ ] No [ ]

If yes, who carries out the assessment

32. **Are adult numeracy programmes evaluated?**

Yes No

33. **Who participates in the evaluation? (please tick as appropriate)**

- Course participants
- Course tutor's
- ALO
- Other (please specify)

34. **Do any of your adult numeracy courses target or attract particular groups? (please tick as appropriate)**

- Adults with literacy and numeracy needs
- Adults without qualifications
- Adults in employment
- Unemployed adults
- Lone parents
- Low income groups
- Travellers
- Migrants
- Other (please specify)

35. **How many adults attended adult numeracy in 2018?**

36. **What is the maximum number of participants per course?**

37. **What is the average number of adults who completed the course?**

38. **What percentage of adult numeracy learners per year progress to other adult learning?**

39. **How many men attended adult numeracy at in your ETB in 2018?**

40. **How many men attended adult numeracy? (please tick as approrpriate)**

- At QQI level 1
- At QQI level 2

- [ ] At QQI level 3
- [ ] Attended unaccredited provision

41. How many women attended adult numeracy at your ETB in 2018?

42. How many women attended adult numeracy?

- [ ] At QQI level 1
- [ ] At QQI level 2
- [ ] At QQI level 3
- [ ] Attended unaccredited provision

43. Do you organise adult numeracy activities in partnership with other groups or organisations?

Yes No

44. If yes, with which of the following do you work with? (please tick as appropriate)

- [ ] Intreo/local employment service
- [ ] Local library
- [ ] Local school
- [ ] HSCL
- [ ] Health visitor or social worker
- [ ] Local community group
- [ ] Other (please specify)

45. Which of the following are involved in adult numeracy delivery? (please tick as appropriate)

- [ ] Full time tutors
- [ ] Part time tutors
- [ ] Voluntary tutors

46. Is training available for adult numeracy tutors?

Yes No

47. What percentage of those working in adult numeracy has received training in the past year?

48. What percentage of those working in adult numeracy has received training in the past five years?

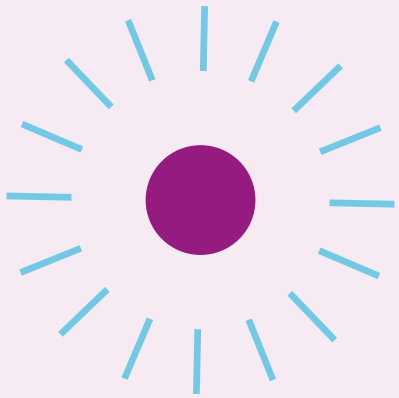
49. What percentage of those working in adult numeracy has received training in the past ten years?

50. Is there an unsatisfied demand for adult numeracy CPD?

Yes No

51. Any other comments

Thank you very much for the time, attention and commitment you have devoted to completing this survey. It is very much appreciated.



Appendix 2. Interview Schedules

Staff interview schedule

Developing best practice for adult numeracy activity in Ireland

In 2019 a national research project will take place into adult numeracy activity in Ireland. The study was commissioned by SOLAS, the Further Education and Training Authority and will be carried out the National Adult Literacy Agency (NALA).

This study seeks to establish how adult numeracy activity can best contribute to government policy in improving literacy and numeracy amongst adults and children in Ireland. It will do this by identifying current practice in the sixteen Education and Training Boards' (ETBs) and by drawing on national and international research in the field. The ultimate goal of the study is to provide research-based evidence that will guide the future development of adult numeracy practice in Ireland.

By taking part in the study, you will add your voice to a project that aims to improve the effectiveness of adult numeracy practice in Ireland. The research process will be informal and relaxed. Data collected from ETBs will clearly identify them and their work. Learners and practitioners who participate in the research process will be assured of anonymity and confidentiality in every aspect of their contribution.

What will happen to the information?

All of the data gathered during the study will inform the final report. Research participants will be asked to give their permission for interviews and focus groups to be recorded and transcribed. Before this happens all personal details will be removed and confidentiality will be assured to all who take part. Participation in the study is entirely voluntary.

The interviews with individuals and the focus group discussions will inform the final report and will ensure that the voices of those with lived experience of adult numeracy tuition will be central to the outcomes, conclusions and recommendations.

Contact details:

Tina Byrne tbyrne@nala.ie ph: 014127917
Fergus Dolan fdolan@nala.ie ph: 014127918

Generic individual interviews and focus group schedule – facilitated by the researcher

(Questions to be selected as appropriate depending on the group make-up/parents/ AEOs/ALOs)

Ethos – for AEOs and ALOs

- What would you say is the ethos/value base that informs adult numeracy tuition?
- When you think of adult numeracy what is the first thing that comes to mind?
- What is the thinking behind providing adult numeracy in this location?
- What would you say is the purpose of adult numeracy tuition?
- How does numeracy address adult's literacy and numeracy needs?
- How does numeracy address adults numeracy development?
- Is there any recorded evidence available to substantiate such developments? How is it recorded?

Programmes/Activities

- Can you tell me how numeracy programmes/ activities are developed?
- Are programmes piloted beforehand? Are there a range of different programmes/activities… can you describe them…. 'off the shelf' or developed with learners?
- What's included in numeracy tuition here?
- Do you ever teach parents specific techniques about how to support their children's numeracy development?
- Do you ever gift books to parents?
- Thinking about numeracy tuition here and from your experience what has worked well?
- Why do you think that is?
- Are there programmes/activities that you have run/have been involved in that did not work?
- Why do you think that is?
- From your experience is accreditation important/ relevant in this context?

Access

- How do participants access numeracy activities?
- Is there a formal procedure?
- How are participants chosen?
- How do you ensure that both men and women can access your courses?
- How did you first hear about numeracy tuition? What made you decide to enrol?

Assessment

- Is there an assessment process in numeracy tuition?
- How is that done?
- When is it done?
- Formal/informal?

Recruitment

- How are participants recruited?
- What has worked well? Why do you think that is?
- What did not work?
- What strategies have you used to recruit men to programmes?
- How have they worked?
- What are the barriers to participation faced by participants?
- What might encourage more people to participate?

Delivery

- What happens during a numeracy session?
- How does that happen?
- What are the elements that make activities/ programmes run smoothly?
- What are the blocks?
- What would you say is the tutor's approach to delivering numeracy tuition?
- From your experience do you use different strategies when working with men only?
- From your experience do you use different strategies when working with men and women?
- How would you describe your relationship with your tutor?
- How would you describe the relationship amongst the group?
- What has contributed to developing those relationships? What have been the challenges?

Evaluation

- How do you evaluate numeracy programmes?
- Is there a written record of evaluations?
- Progression: from your experience what are the progression options for adults who participate in numeracy programmes?
- Other courses/employment
- How is data gathered about progression?

Tutors

- What qualities, skills and knowledge do tutors need to work well in adult numeracy?
- What qualifications do you think are important?
- What training do numeracy tutors have?
- Can you tell me about opportunities for professional development that are available for numeracy tutors?
- Have you any ideas for training that might further support tutors in their practice?

Partnerships

- What local community partners are involved in numeracy in this area?
- Schools/Libraries/HSCL/DEIS/Health visitors/ Barnardos/Local Credit Unions/Local Banks NALA
- How are they involved?
- What's working well? What are the challenges? How could relationships be strengthened?
- What are the benefits of such partnerships to participants? To the ETB itself?

Numeracy benefits

- From your experience how do **adults** benefit from participating in numeracy programmes/activities?
- Literacy and language development/Numeracy/ ICT/Irish
- Other – confidence, friendships, school relationships, community involvement. Any specific examples? Anecdotal outcomes?
- Any attitudinal changes noted re-education? Are there any changes about expectations of their own or their children's educational attainment?
- From your experience how do **children** benefit from their parents' participation in numeracy programmes?
- Other – confidence, friendships, family relationships, school relationships
- Any specific examples? Anecdotal outcomes?
- Is there any evidence available about improved child attendance in schools?
- Homework completion?
- Are there wider benefits associated with taking part in numeracy activities for **families, for schools and communities?**
- Are there benefits for the **ETB** itself?
- In your opinion what would the Guidelines prioritise, what would the content be, what is most needed?
- Is there anything I should have asked you that I didn't?
- Is it ok to contact you again if I need to clarify something?

Interview schedule adult numeracy learners

Participant Profile

I'm going to start by asking you some questions about your learning and your school experiences, if at any time you feel uncomfortable or don't want to answer the questions let me know and we'll move on to talk about something else.

- Can I start by asking you your name, age?
- How long is it since you left school, what age were you? How far did you go in school? Did you leave with any certificates for example the primary certificate?
- Did you get support at home, with your schoolwork? Who would have been the person to give you the most support and encouragement?
- How did you find maths work in school? Did you find it easy, difficult? Can you tell me what you felt the main difficulties were?
- Can you remember when you first started to notice that you were having difficulty? Can you remember what you felt/thought at the time?
- What job did you work at after you left school, what were your plans for the future? Did you ever want to do anything else, but felt that you were not able to, can you tell me about that?
- Do you think that having numeracy needs has held you back, if yes, how, can you give me an example?

Engagement/Referral/Enrolment with Learning Centre

- How did you first hear about numeracy tuition?
- What made you decide to enrol?
- What were the steps you took to enrol?
- What was your main reason for making the decision to enrol in an adult numeracy class?
- What were the barriers if any to returning?
- What supports have helped you overcome these barriers?

Experiences

- How long have you been enrolled on the course
- What do you think of the course, its content relevance and the number of hours you spend there?
- Is this course accredited is this something you are interested in?
- What happens during a numeracy session?
- How does that happen?
- What are the elements that make activities/ programmes run smoothly?
- What are the blocks or barriers?
- What would you say is the tutor's approach to delivering numeracy tuition?
- How would you describe your relationship with your tutor?
- How would you describe the relationship amongst the group?
- What has contributed to developing those relationships? What have been the challenges?
- Would you like to continue your learning? – what next when this course is finished?
- What are your expectations from this course?
    - More involvement in children's education
    - More involved in community activities
    - Return to or promotion at work
    - Better social life

Numeracy benefits

- From your experience how do you benefit from participating in numeracy programmes/activities?
- Numeracy development/ICT?
- Increase in confidence, friendships, school relationships, community involvement. Any specific examples?
- Are there any changes in your attitude in your expectations of your own or your children's educational attainment?
- From your experience how do your children benefit from your participation in numeracy programmes? Improved attendance in schools? Homework completion?
- Are there wider benefits associated with taking part in numeracy activities for your family?

Thank you again for agreeing to take part in this interview

- Is there anything I should have asked you that I didn't?
- Is it ok to contact you again if I need to clarify something?

SOLAS – An tSeirbhís Oideachais Leanúnaigh agus Scileanna

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