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A European study investigating adult numeracy education: Identifying challenges and possible responses

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Abstract

Numeracy is a critical competency needed by adults to navigate their way through tasks in their personal and professional lives. Hence, it is critical that efforts are made to identify and address challenges that prevent adults from developing the numeracy skills needed to engage in society. In this research we identify the challenges facing adult numeracy eduction across Europe. A survey, which sought to investigate the main challenges faced by adult educators and policy-makers when delivering numeracy programmes, was distributed to leading figures in adult numeracy education in EU states. Twelve countries responded and challenges identified related to the lack of a standardised definition of numeracy, the lack of a standardised framework to support adult numeracy education and the need for professional development for adult numeracy tutors. In this paper we look at how these challenges manifest themselves in different jurisdictions and offer suggestions for overcoming these challenges in future.

Keywords: numeracy, adult education, professional development, challenges

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Introduction and overview of literature

There are many important topics of study in the field of adult education, however recently adult numeracy has been at the forefront and indeed a priority of adult education around the world. Gal et al. (2020) ascertain that adult numeracy is a field which is of growing interest to economies internationally. Numeracy skills are critically important for the adult population in order to allow adults to meaningfully engage in society; to ensure good job prospects and in turn the opportunity to earn a reasonable wage; and furthermore to protect their physical and mental wellbeing (Carpentieri et al., 2010; Parsons & Bynner, 2005; Tout et al., 2017). Research shows that adults with higher competency in literacy, numeracy and problem solving in today's mathematised world, tend to have better outcomes in attaining a job than their less-proficient peers (Organisation for Economic Co-operation and Development [OECD], 2016). On the other hand, low numeracy levels amongst adults can also contribute to intergenerational cycles of inequality and disadvantage in families (Carpentieri et al., 2010). Coben et al. (2003) summarised the impact issues relating to poor numeracy can have when they outlined how low levels of numeracy not only affects the individual but also economies and societies as a whole. As such, it is vital to have a numerate society in order for an economy to flourish and people to reach their full potential.

Despite the clear and obvious need for adults to be proficient in numeracy, international studies suggest that many adults struggle in this area. In the United Kingdom, a study conducted by National Numeracy (2019) found that 56% of adults displayed numeracy skills which were the equivalent to that expected of a primary school child, while only a quarter of the adult population displayed levels of proficiency in numeracy at or above the level expected of a 16-year-old In addition to reports such as this, the Programme for International Assessment of Adult Competencies [PIAAC] has also been used regularly by Governments and policy makers internationally to determine adults' level of proficiency in the area of numeracy. This international assessment measures adults skills and competencies in a number of different areas, including numeracy, literacy, information processing and problem solving skills). In this assessment adults are categorised into one of six proficiency levels for numeracy and a description of each of the different proficiency levels is provided in Table 1 (OECD, 2016, p. 49).

The most recent PIAAC study shows that, on average, across all 28 OECD countries surveyed, 22.7% of adults are performing at or below Level 1 (OECD, 2016). In essence, these adults are not capable of going beyond one-step processes in the area of numeracy, nor are they capable of dealing with problem scenarios where the numeracy component is not explicit. In contrast to this, the corresponding percentage of adults performing at or below Level 1 for literacy is 18.9%, thus showing that adults performance in the area of numeracy was substantially lower than that of literacy, albeit neither are at the desired level. Furthermore, in some European countries, such as Turkey and Greece, a much higher proportion of adults (38.47% and 24.98%, respectively) are performing at or below Level 1 in the area of numeracy (OECD, 2016). At the other end of the spectrum, results from the 2016 survey shows that, on average, only 1% of adults are performing at the highest possible level (Level 5). While these figures are concerning, the review of data in these reports revealed much more worrying trends upon closer inspection. As part of the PIAAC study each country's score for numeracy proficiency was calculated. The OECD average score for numeracy was 263, thus suggesting that the average adult performed at Level 2 on the proficiency scale. However many European countries[1] including Turkey (216); **Spain** (246); **Greece** (252); France (254); **Ireland** (256); Slovenia (258); Northern

Ireland (259) and Poland (260) all performed significantly worse than the OECD average (OECD, 2016).

Table 1. Description of proficiency levels in numeracy

Level	**Descriptor**
Below Level 1 <176	Tasks at this level require the respondents to carry out simple processes, such as counting, sorting, performing basic arithmetic operations with whole numbers or money, or recognising common spatial representations in concrete, familiar contexts where the mathematics content is explicit with little or no text or distractors.
Level 1 [176, 226)	Tasks at this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit, with little text and minimal distractors. Tasks usually require one-step or simple processes involving counting, sorting, performing basic arithmetic operations, understanding simple percentages, such as 50%, and locating and identifying elements of simple or common graphical or spatial representations.
Level 2 [226, 276)	Tasks at this level require the respondent to identify and act on mathematical information and ideas embedded in a range of common contexts where the mathematics content is fairly explicit or visual with relatively few distractors. Tasks tend to require the application of two or more steps or processes involving calculation with whole numbers and common decimals, percentages and fractions; simple measurement and spatial representation; estimation; and interpretation of relatively simple data and statistics in texts, tables and graphs.
Level 3 [276, 326)	Tasks at this level require the respondent to understand mathematical information that may be less explicit, embedded in contexts that are not always familiar and represented in more complex ways. Tasks require several steps and may involve the choice of problem-solving strategies and relevant processes. Tasks tend to require the application of number sense and spatial sense; recognising and working with mathematical relationships, patterns and proportions expressed in verbal or numerical form; and interpretation and basic analysis of data and statistics in texts, tables and graphs.
Level 4 [326, 376)	Tasks at this level require the respondent to understand a broad range of mathematical information that may be complex, abstract or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem-solving strategies and processes. Tasks tend to require analysis and more complex reasoning about quantities and data; statistics and chance; spatial relationships; and change, proportions and formulas. Tasks at this level may also require understanding arguments or communicating well-reasoned explanations for answers or choices.
Level 5 ≥ 376	Tasks at this level require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.

In addition to the aforementioned low levels of proficiency in the area of numeracy, research also indicates that many adults also hold negative attitudes towards numeracy. Feelings of fear and anxiety, which is commonly referred to as 'mathematics anxiety' among the adult population, is a well reported emotion in this field. 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. 551). 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 (Tobias, 1993; Klinger, 2011). Such

experiences may include the use of traditional teaching methodologies, where mathematics involves the memorisation of formulae, and the following of rules and procedures (Prendergast et al., 2014). While many adults recognise the cultural and societal benefits of being numerate, they still report it to be a difficult and demanding skill that they often fear and dread (Swain et al. 2005). For example, according to the work of Breen (2003) and Southwood (2011), mathematics anxiety, is the emotion often reported by adults when confronted with numeracy tasks and it has a negative impact on their willingness to engage with numeracy and on their performance in the domain. Furthermore, Klinger (2011) found there to be a strong relationship between adult innumeracy and maths anxiety. However, Carpentieri et al. (2010) found that emotions relating to fear and anxiety were not only reported by innumerate adults or those with low levels of proficiency in numeracy, but adults who are highly qualified and successful also often lack confidence in their mathematical ability. Such findings highlight that negative dispositions towards numeracy are prevalent among the adult population, regardless of their mathematical capabilities, and this further emphasises the strong correlation between the affective domain and academic performance in a subject area, especially in the area of numeracy.

Due to the ramifications of poor attitudes and poor performance in the area of numeracy, it is of paramount importance that potential causes of these issues are investigated. However, despite acknowledgement of the existence of such problems and despite calls from policy makers and government bodies for adult numeracy to be prioritised, it still remains an under-researched and under-theorised field. There is a dearth of research in the field of adult numeracy and very few researchers have sought to identify the challenges or obstacles that are contributing to poor performance and poor attitudes towards numeracy among the adult population. It is this gap in the literature that this study is seeking to address. However, prior to this the authors will consider some findings in relation to numeracy education that could help identify some of the problems and issues relating to numeracy discussed to date.

Issues in the teaching and learning of numeracy among adults

One of the first issues facing the teaching and learning of numeracy identified in the literature is in relation to the definition of the term numeracy. The first concern in relation to the definition of numeracy, is the plethora of terms used to define numeracy internationally. O'Meara et al. (2022) outline how a multitude of different and evolving definitions and terms have been used when describing numeracy and numerate competencies in the past. A review of literature in the field of numeracy, shows that there exists many comparable terms for numeracy such as mathematical literacy or quantitative literacy. The terms used often depend on the country or jurisdiction, and these can be used interchangeably in some instances, without distinction. This can lead to a vague and confused understanding of the concept of numeracy.

Quantitative literacy is the term used for numeracy in the United States and is defined as the ability of a person to work effectively with quantitative data in all aspects of life (Steen, 2001). The Quantitative Literacy Design Team (2001), which developed this notion, acknowledged that quantitative literacy also included 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. This leads to a second issue in the teaching and learing of

numeracy, the lack of a clear definition of numeracy. Frejd and Geiger (2017) revealed that while numeracy is a word that is recognised internationally, there are many different interpretations and definitions of the term. Likewise, Hoogland & Diez-Palomer (2022, p. 21) ascertain that '…there is no a single, consensual, definition for numeracy'. Instead, the term numeracy has a multitude of definitions with many definitions portraying a very narrow view of numeracy. The initial concept of numeracy was first introduced in 1959 in the Crowther Report, whereby the word 'numerate' was defined as a word to mirror the image of literacy, while also including the skills necessary to think quantitatively. This initial definition is quite vague and led to many people seeing numeracy as a component of literacy. Later in 1982, the Cockcroft report offered a broader definition when they ascertained the word 'numerate' to have 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' (Cockcroft, 1982, p.11). This definition, while broader, began to link numeracy to basic mathematical skills and such interpretations of numeracy have persisted in the intervening years. For example, when more recent policy documents discuss the term numeracy there is a tendency to suggest that numeracy is the basic mathematical skill embedded in the description of literacy (Department of Education and Skills [DES], 2011; United Nations Educational Scientific and Cultural Organisation [UNESCO], 2006). In addition to this, 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. However, this view of numeracy as basic mathematics skills has, of late, been contested and criticised. For example, the asessment framework for the second cycle of PIAAC is very reluctant to define numeracy as basic mathematics skill (or a compendium of basic arithmetic skills). Instead this report ascertains that numeracy is now seen as 'a sophisticated capability requiring more than just arithmetic calculations and basic mathematics.' (OECD, 2021, p. 113). The definitions presented thus far all have subtle but important differences, highlighting the lack of consistency across the explanations of numeracy. This, coupled with the simplistic view of numeracy that permeates the literature, means that it is difficult for policy makers, adult educators and the general public to fully appreciate the importance of numeracy and furthermore reiterates the need to fully understand what is required for the meaningful teaching and learning of numeracy.

The second potential challenge identified by the authors in the review of literature in adult numeracy education, was in relation to financial support and the availability of funding to support adult numeracy education. While research has shown, that there is currently a strong focus on the importance of numeracy provision, the funding provided to enhance the teaching and learning of numeracy to adult learners continues to be deficient. Perso (2006) highlights that government bodies in Australia place a strong emphasis on improving the literacy and numeracy skills of young people but the focus is predominantly on literacy. There is an abundance of funding for literacy programmes which has improved teachers' understanding of literacy, which in turn improved the literacy skills of the young people. On the other hand, Perso (2006) explains how there is a lack of funding for numeracy programmes. While literacy is an essential domain for numeracy, given that the development of numeracy skills among adults would be extremely difficult without those adults having good literacy skills, it is still important

that a balance, in terms of the funding made available for literacy and numeracy programmes, is achieved internationally. In a subsequent Australian study, Westwood (2008) describes the funding for research into literacy interventions as exceeding what was offered in the numeracy domain and describes this as one of the main reasons that numeracy policies have been neglected until recent years. Carpentieri et al. (2010) reiterated this sentiment in relation to adult education when it was stated that, 'in the field of adult education, literacy has consistently taken prominence over numeracy' (p. 9). Furthermore, in the UK Parsons and Bynner (2005) acknowledge that people worldwide recognise the importance of literacy skills but they are of the belief that numeracy skills continue to be undervalued and underappreciated.

The review of literature has identified issues regarding a clear definition of numeracy and the lack of funding available for numeracy education. Such issues undoubtedly have an impact on the opportunities available to adult learners to engage in numeracy initiatives; on adults' academic performance in the area of numeracy and on their disposition towards numeracy. As such, the authors are keen to investigate if these are the only challenges facing adult numeracy providers in Europe or if there are other challenges hindering the meaningful teaching and learning of numeracy to adult learners. The literature review has shown that a significant research effort is needed in order to fully understand and address the challenges of improving adult numeracy education around the world. This paper discusses challenges identified in Europe as part of the development of the Common European Numeracy Framework (CENF) and furthermore it seeks to offer some suggestions for overcoming some of these challenges going forward.

Research question

In light of the extensive literature review the authors ascertained that there was a dearth of research in relation to the specific challenges facing those involved in adult numeracy education. As such, the following research question was identified to guide this research:

1. What are the most significant challenges and obstacles affecting the meaningful delivery of adult numeracy education across EU states and how can these obstacles be overcome in the future?

Methodology

To address this research question the study employed a survey research design. According to Visser et al. (2000), survey research is a methodology that involves the collection of data from a sample drawn from a well-defined population at a given point in time. Surveys and questionnaires containing questions about a topic of interest are at the heart of this methodology. As part of this research design the authors created a research instrument which allowed them to collect a mixture of quantitative and qualitative data. The authors intended to get a large response rate from the 44 European countries and they felt there may be a higher response rate if they used a research instrument that was easy to distribute and one that the participants did not find too time consuming to complete. In addition to this, they were cognisant of the need for the research tool used to be distributed internationally in a convenient and efficient manner. As a result, for the purpose of this study, an online questionnaire was designed using the Google platform and was distributed to national adult education agencies across 33 European jurisdictions. The authors requested that those responsible for co-ordinating the teaching and learning of numeracy to adults in each of these jurisdictions complete the questionnaire.

The questionnaires were designed with the help of a Research Advisory Group (RAG), which consisted of four leading academics who have conducted much of their research in the field of adult numeracy and numeracy education. English was the native tongue to two members of the RAG and the second language for the remaining two members. The academics involved in this group were experienced in their positions and were recruited using a purposive sampling method (each academic was part of the wider project team). The academics in the advisory group were not research subjects and as such did not complete the questionnaire. Rather they were invited to participate on the basis of the expertise they could bring to the research and the contemporary experiences they have in similar peer groups to the research participants (Murphy et al., 2013). Their remit was to advise the authors on the development and distribution of the questionnaire and to provide a key stakeholder perspective to any of the issues raised in the literature review. There were two meetings held with the RAG. Prior to the first meeting the authors had conducted an extensive literature review investigating the teaching and learning of numeracy to adults internationally that would underpin the study. This enabled the authors to identify various issues associated with numeracy education and these issues were discussed with the RAG during the first meeting. The issues included society's understanding of numeracy, adult education and the provision of numeracy education in this setting. Following this discussion, a structure for the online questionnaire was put in place and key areas for investigation were decided upon. The second meeting of the RAG involved the piloting of the research instrument with the four academics. They advised that the wording of some questions was ambiguous and at times misleading, particularly for an international audience and made some suggestions for rewording. Other issues relating to phrases or terms that had different meanings in different jurisdictions were also identified by members of the RAG. Finally, recommendations were also made regarding the inclusion of a new section in the questionnaire which focussed on the working definition of numeracy. This advice was heeded and an additional section was added to the questionnaire. Finally, the RAG also gave the authors some advice in relation to the identification of participants for the study and provided a list of contacts that they had in adult education settings across Europe.

The questionnaire consisted of seven sections. The focus of each section along with the type of questions asked in each section is described in Table 2.

This paper will focus specifically on different items in the questionnaire that focussed on challenges facing adult numeracy education. These items were found in Section B and Section D of the questionnaire. The questionnaire items that were analysed for the purpose of this paper were:

B2. Is there a standard definition for numeracy for adults in your jurisdiction?

B6. Do literacy and numeracy for adults have the same status in your jurisdiction? Please explain.

D1. Who mainly educates adult learners in numeracy in your jurisdiction?

D2. How often do teachers or volunteers receive professional development for teaching numeracy?

Table 2. Nature of Questions in Online Survey

Section	Focus	No. of Questions	Question Type
A	Demographics	7	6 open-ended 1 multiple choice
B	Concepts & policies for adult numeracy education	15	2 dichotomous 7 open-ended 5 multiple choice 1 Likert scale
C	Content & practice	11	1 dichotomous 8 open-ended 2 multiple choice
D	Teachers/trainers & volunteers	5	1 dichotomous 1 open-ended 3 multiple choice
E	Learners' experience of numeracy and levels of proficiency	7	6 open ended 1 multiple choice
F	Working definition of numeracy	7	1 open ended 6 Likert scale
G	International co-operation and support	3	3 open ended

The sampling method employed for this research study was convenience sampling. Whilst non-probabilistic sampling methods, such as convenience sampling, are considered a limitation the research team and the RAG, due to their own experience in the field, had well-established, formal working relationships with many policy makers and academics who had many years expertise in the field of adult numeracy. Many of these people were responsible for the co-ordination, organisation and delivery of adult numeracy education in their jurisdiction and so we felt they were best placed to answer the questions in the online survey. The sampling frame for the study was the 33 EU countries in which one member of the research team had a connection with the body/organisations responsible for adult education. In order to disseminate the survey, in each of the 33 jurisdictions, an organisation was contacted and invited to participate or alternatively nominate another individual or organisation in their jurisdiction whom would be in a better position to offer insights into the provision of numeracy education in the adult population. In using this approach 52 people/organisations were contacted and 12 jurisdictions nominated an individual who submitted a response to the survey. This response rate of ~37% is in line with the expected response rate of 40% for online needs assessment surveys (Archer, 2008). Once these responses had been submitted the research team were in a position to begin the analysis phase of the study. The quantitative data was recorded, summarised and analysed using the computer package SPSS. The open ended questionnaire responses were transcribed and analysed using NVivo. Thematic analysis was employed to analyse this qualitative data. Thematic analysis involves identifying, analysing, and reporting patterns/themes across the data set. It is used to examine the ways individuals make meaning of their experiences and thus was relevant to this study (Braun & Clarke, 2006). The research team followed Braun and Clarke's six step approach when conducting thematic analysis on the qualitative data:

1. Familiarising oneself with the data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes

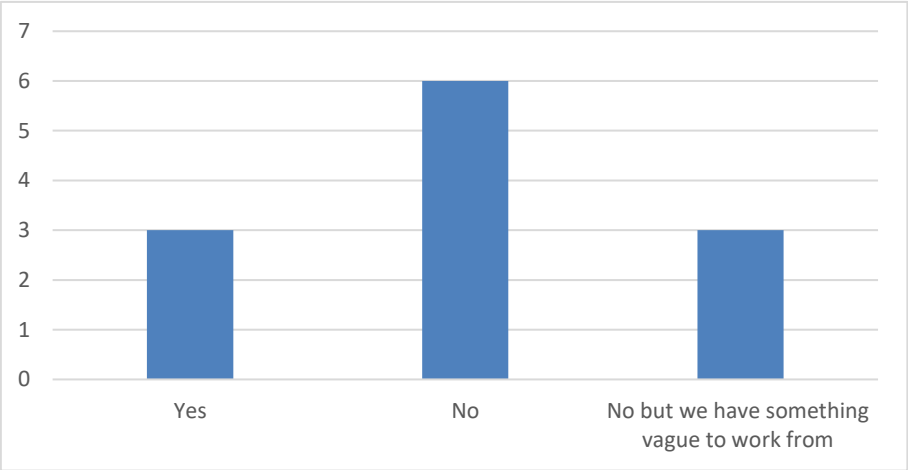
5. Defining and naming themes
6. Producing a report

Each of the authors worked individually during the initial three phases and derived their own codes. The coding allocated by each researcher was then compared during phase 4 and any discrepancies were discussed and resolved by the authors before the coding scheme was finalised in phase 5. The findings that emerged from both the quantitative and qualitative data will be discussed in the next section.

Findings

The first challenge that emerged in this study was in relation to a lack of clarity surrounding what numeracy entails. This issue first came to the fore when respondents were asked if there is a standard definition for numeracy in their jurisdiction. In total 12 people offered a response to this question and the results are summarised in Figure 1.

Figure 1. Responses when asked if there was a standardised definition of numeracy used in their jurisdiction



From Figure 1 it is evident that in three-quarters of the jurisdictions involved in this study there was no standardised definition of numeracy. Respondents from six jurisdictions reported that there was no definition adopted from international reports, or otherwise, that they use when teaching numeracy. Instead, respondents in these jurisdictions believed that individuals each arrived at their own conceptualisation/interpretation of numeracy, although there was often consenus in these interpretations as indicated by respondent 10:

> R10: No [standardised definition], but there is a widely accepted view

The authors believe that the lack of a standardised definition for numeracy will have a multitude of knock-on effects for the teaching and learning of numeracy and will result in numeracy being misconstrued by adult learners and educators alike. This latter issue around the lack of appreciation or understanding of numeracy, what it entails, its scope, and the role numeracy skills play in the life of adult learners was also identified through a second item on the survey. When asked to outline the terms used for adult numeracy in their jurisdiction two responses featured much more frequently than any other. The first,

mentioned by four respondents, was that numeracy was considered the equivalent of basic mathematical skills or a ‘basic knowledge of mathematics’. Sample responses include:

> R3: basic knowledge of mathematics
> R10: …numeracy is normally descried as basic or everyday maths

This, according to Goos et al. (2019), Tout et al. (2017) and OECD (2021) amongst others, is an extremely narrow conceptualisation of numeracy and highlights that without a standardised and modern definition of numeracy, it will continue to be a term that is misunderstood and misrepresented in the field of education. The findings from our study also show that a second common term used to describe numeracy across a number of European countries is ‘mathematical literacy’. This was the response offered by a further four respondents.

> R9: There is no Spanish word for numeracy and we translated as “Alfabetizacion matematica” (Mathematical literacy)

Defining numeracy as mathematical literacy or as a mirror image of literacy in a numerical sense presents another challenge for numeracy education and a challenge that was again identified in responses offered to a variety of items in the survey and relates to the status attributed to numeracy education, particularly when compared to literacy.
This second challenge that emerged when analysing the qualitative data collected in response to the survey item ‘Do literacy and numeracy have the same status in your jurisdiction? Please explain’ found that only two of the respondents asserted that numeracy and literacy were held in the same regard in their jurisdictions. A sample response from one such jurisdiction was as follows:

> R11: Yes both are listed within the framework of basic functional literacy in adult education.

However, the vast majority of jurisdictions (n = 10) believed that literacy was held in much higher regard than numeracy, with two of these jurisdictions reporting that efforts were being made in recent years to address this imbalance. The following sample responses give some indication of the scope of the challenge numeracy in adult education is facing in this regard:

> R2: No literacy is actually more important and visible than numeracy. Probably affected people can hide this [numeracy] weakness in their daily lives and there is a lack of awareness in society.

> R6: In the past this was not the case and literacy took precedent. However, numeracy has been gaining more importance in recent years.

> R3: Yes, according to the law (Federal Act) numeracy is part of the basic skills, which must be promoted by the federal state and the regional states (cantons). Basic skills are: (a) Reading, writing and oral expression in a national language; (b) “basic knowledge of mathematics” and (c) application of ICT. De facto, financial flows, public awareness and the political will to support reading, writing and language skills are disproportionately higher compared to support for numeracy.

> R8 : Numeracy is merely seen as part of (multiliteracy) so in that sense it doesn’t appear to be an equal to literacy.

These responses clearly highlight that literacy is held in higher regard than numeracy across the majority of European countries. This was also an issue raised later in the questionnaire when respondents were asked to identify the biggest issue that faced numeracy education going forward. The following response from Jurisdiction 5 reinforces the idea that numeracy is seen as a poorer relation to literacy:

> R5: Hidden behind literacy – 'literacy and numeracy' So often within discussions of literacy and numeracy, the two are written and spoken of in combination as if they are a single skill, with literacy frequently used as a proxy for both.

While the response from Jurisdiction 6, above, offers some hope for the future of adult numeracy education, the response from Jurisdiction 3 highlights an additional layer to this problem. Notably, they assert that while official state documents attribute equal status to numeracy and literacy, the situation on the ground is quite different. They believe that in their jurisdiction the financial support available for literacy, the public awareness of literacy and the political desire to develop literacy skills supersedes that of numeracy, irrespective of what is stated in policy documents. This must also lead us to question those jurisdictions where it was reported that numeracy and literacy were of an equal standing. Despite a small number of respondents (n = 2) in this study professing that numeracy and literacy were equally weighted, the rationale underpinning their belief in this regard was that policy documents attested to this (see response from Jurisdiction 11). However, as many research studies have found in the past (Quirke, 2018) and as has been discovered in this study what happens in practice can often differ quite substantially from what is advocated for in policy documents. Additionally, when the authors analysed the responses to this question, another challenge that arose was in relation to a lack of awareness of the importance of numeracy and negative attitudes that persist towards numeracy among society. One respondent argued that society perceive mathematics to be difficult which may contribute towards the prevalence of negative attitudes:

> R12: Bias towards difficulty of mathematics

Another respondent stated that society are not aware of the importance of numeracy which in turn has an effect on the way in which it is viewed when compared with literacy.

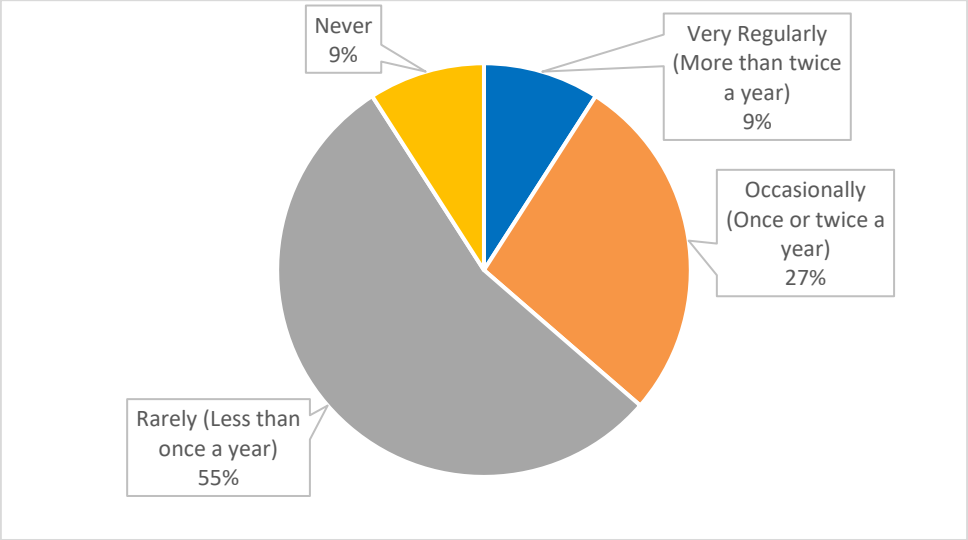
> R1: a lack of awareness around the importance of numeracy.

As a result, while over eighty percent of respondents in this study indicate that numeracy is viewed less favourably compared to literacy, the true extent of this problem might be even greater than that reported here.

The final challenge noted by the authors was in relation to the responsibility for delivering numeracy programmes to adult learners. Respondents to the survey were asked to provide details about the people who deliver numeracy programmes to adult learners and to describe the training/education that these tutors received in relation to the teaching of numeracy. Initially, the findings in relation to numeracy tutors were positive in that six of the eleven people that responded to this question indicated that professionals (i.e. those with a recognised qualification in the area e.g. qualified teachers in the subject area) were the only people responsible for the delivery of adult numeracy education in their jurisdiction, while a further two respondents indicated that the responsibility for the delivery of adult numeracy programmes lay with both professionals and trained personnel. Only two respondents indicated that untrained volunteers were responsible for the delivery of adult numeracy education. However, when the authors further investigated the level of training that these professionals/volunteers received, a more concerning

picture began to emerge. As part of the survey, respondents were asked to describe how often teachers/volunteers received professional development in the area of numeracy education. The responses are summarised in Figure 2.

Figure 2. Summary of responses in relation to how often do professionals/volunteers receive professional development for teaching adult numeracy



Respondents from 11 different European countries offered a response to this question. Figure 2 shows that the majority of jurisdictions (n = 7) reported that tutors of adult numeracy rarely or never received professional development in the area of numeracy, while on the other hand only one country reported that professional development is made available to these tutors more than twice a year. The importance of professional development for teaching cannot be understated, as will be discussed in the next section, and hence the findings to emerge here present a significant challenge that must be overcome if looking to improve the teaching and learning of numeracy among the adult population.

Overall, the three challenges discussed thus far were identified as the most pertinent issues facing adult numeracy education across European jurisdictions. Many of these were also explicitly stated by respondents when asked what they believed to be the most significant challenges facing numeracy education in the future.

Discussion and conclusion

Government bodies and educators around the world have advocated that numeracy is a skill that all adults need to possess. However, the results from this study identified some challenges in relation to supporting the development of adult numeracy. The authors identified three challenges that emerged from this research study which may have an effect on adult numeracy education, namely; the lack of a clear definition of numeracy; an imbalance in the attention and funding afforded to numeracy when compared with literacy; and a dearth of professional development opportunities available for adult numeracy tutors.

This research study explored the standardised definitions of numeracy in different jurisdictions and it emerged in the findings that there is a lack of clarity around what numeracy entails. The review of literature showed that very often the meaning of numeracy may be embedded in a definition of literacy (Ministry of Education, 1959; UNESCO 2006). As presented in the findings of this paper, over 75% of respondents were not aware of a standardised definition of numeracy in their jurisdiction. The study was conducted across 12 different European countries, the majority of which do not use English as their first language, and this could have been a factor that contributed to this finding, since Bolstad (2019) claims that numeracy is a relatively new phenomenon which can be difficult to define, especially as it is not a term that easily translates to different languages. Regardless of the cause, these findings support the work of Frejd and Geiger (2017), who acknowledge that there are many different definitions of numeracy and they argue that this can often lead to misunderstandings regarding the role of numeracy development within the field of education. The findings from this research study relating to a standardised definition revealed that there is a need for a clearer definition of numeracy that can be utilised across different jurisdictions. It is essential that those responsible for teaching and developing numeracy in adult education are provided with a clear standardised definition of numeracy which will further support their own understanding of numeracy. Consequently, a common standardised definition for numeracy needs to be developed and work has commenced on a framework to support teaching and learning of adult numeracy, as part of this European project (Hoogland et al., 2021). Further research is now required into the suitability of this framework and how it can be used to develop policy makers and the general publics' awareness and understanding of the term 'numeracy'.

The second challenge identified as part of this research study was in relation to literacy and numeracy holding an equivalent role in adult education and society as a whole. Literacy and numeracy are often referred to as essential skills that everyone needs to possess to engage fully in society but it is well recongised that neither receive the investment or recognition required in international policies. However, despite issues neing identified in the provision of both numeracy and literacy education to adult learners, it is acknowledged that developing skills in literacy often takes precedence over numeracy. This research study found that only two respondents agreed that literacy and numeracy are afforded the same status with one respondent stating 'Yes both are listed within the framework of basic functional literacy in adult education.'. However, the fact that the respondent justified that both skills are part of the 'functional literacy' framework reinforces the idea that numeracy is seen as part of the broader skill of literacy. O'Donoghue (2002) argues that because the term numeracy was introduced after the term literacy, often the two terms are merged together or sometimes numeracy even becomes a subset of literacy. This notion that numeracy is part of the overall competency of literacy was highlighted even further when the majority of respondents argued that theoretically government bodies place a strong emphasis on improving both literacy and numeracy skills, however, they argued that the focus on the ground is predominantly on improving literacy. Carpentieri et al. (2010) state that in order for an economy to continue to grow, it is necessary to improve both the literacy and numeracy skills of the adult population, with more emphasis now needing to be placed on the latter. Moreover, this research study revealed that funding is one of the factors that contributes to the imbalance and inequity between literacy and numeracy. Respondents believed that in their jurisdiction, the financial supports available for literacy development, along with the public awareness of the importance of literacy and the aspiration by government bodies to develop adult literacy skills exceeds any supports for numeracy development, irrespective of what the

policy documents state. As a result, the authors argue that it is necessary to place a stronger emphasis on numeracy so that people view literacy and numeracy as equally important. They also support the notion that literacy and numeracy are very distinct competencies and numeracy should no longer be seen as a subset of literacy.

The final challenge identified as part of this research study, was the lack of professional development to support tutors in teaching numeracy in adult education settings. This research study revealed that firstly there is a need for a standardised definition for numeracy, which in turn will help support tutors in facilitating adult numeracy development. This study also revealed that the people responsible for facilitating and teaching numeracy programmes rarely receive any supports or professional development to help them in their mission to develop the numeracy skills of adult learners. Bennison et al. (2020) argue that there is a lack of professional development in relation to teaching numeracy in post-primary school settings. A similar issue was revealed as part of an Irish study in the adult education context, whereby it was recommended that tutors supporting adult learners' development of numeracy skills need to have the necessary qualifications and furthermore should attend Continuous Professional Development (CPD) to support them in their job (National Adult Literacy Agency, 2021). However, this study reveals that this is not a problem confined to Ireland. Instead, it is evident that there is a lack of CPD for professionals who deliver the adult numeracy programmes across Europe and this needs to be addressed and prioritised if we are to improve the numeracy competencies of adults in Europe. Research needs to be conducted into what constitutes effective professional development in this field and based on the findings from such a study programmes of professional development need to be developed for adult numeracy tutors internationally.

While there were some limitations associated with this study, most notably a lower than desired response rate, the authors believe that a number of recommendations can be made based on the findings of this European research study. The first recommendation is to identify a standardised definition and framework that can be used across multiple jurisdictions when supporting adults numeracy development. As mentioned previously, this work is already underway as part of the Common European Numeracy Framework Erasmus project (Hoogland & Diez-Palomer, 2022). Secondly, it was obvious that literacy and numeracy are not competing on a level playing field. This study revealed that the majority of European countries who completed the survey perceived literacy to be more important, with some arguing that it was due to the negative public perception towards mathematics and others arguing that literacy development receives more financial support. Therefore the authors recommend that key stakeholders promote numeracy development in a positive light and can do so by ensuring more financial supports are made available to the adult numeracy education sector. This, in turn, will support and recognise the equal importance of literacy and numeracy. Finally, the findings of this study revealed the need for more continuous professional development for tutors who are facilitating adult numeracy education programmes. Additionally, the authors recommend that the tutors who are responsible for delivering and facilitating adult numeracy programmes possess the necessary knowledge and qualifications for teaching numeracy. It is essential that those responsible for developing adults' numeracy skills have a deep understanding of numeracy, along with the necessary teaching strategies to support the adult learners development and programmes need to be designed internationally to help tutors develop the required knowledge and skills for this endeavour.

The findings presented in this paper raise many questions about the provision of numeracy in adult education. Furthermore, the study helps to reiterate the fact that adult

numeracy education is complex. However, action has now been identified in this study that could help to restore balance in the emphasis being placed on the key skills of both numeracy and literacy for adult learners international. Such reccommendations, if heeded, have the potential to result in better proficiency in numeracy among adult learners across the continent which in turn will help alleviate some of the issues associated with low levels of numeracy such as lower incomes, employment stuggles, and health problems. Likewise, the recommendations made in this paper could potentially lead to improved adult education in the future, and in particular numeracy programmes, ensuring that the emphasis is placed on developing adults as active citizens that can live, work, socialise and critically engage in modern society in a confident and appropriate manner.

Notes

[1] Those countries in bold are involved in this research study.

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The authors declare no potential conflicts of interest with respect to the research, authorship or publication of this article.

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