



Adult Numeracy & Museums and Archives

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Adult Numeracy and Museums and Archives

1. Introduction

Research suggests that numeracy skills affect life chances and ambitions, from childhood and into adulthood. For both men and women, having skills below entry level 3 (skills expected of an 11 year old)ⁱ appears to greatly impede full economic and social participationⁱⁱ.

The *Skills for Life* strategyⁱⁱⁱ, when launched in March 2001, provided a framework to tackle poor literacy and numeracy (subsequently updated to include language). Improvements in numeracy have not been as rapid as those in literacy in terms of learners' participation and achievements. This had been thought to be due to the willingness of people to accept poor numeracy skills as a norm but the National Research and Development Centre (NRDC) has shown that it is more likely to be fear that keeps adults away from learning^{iv}. Museums, libraries and archives have developed provision to meet the needs of *Skills for Life* learners, predominantly focused on literacy and language development. However, the potential also exists within the sector to help to improve the numeracy skills of adults.

2. Background and Context

Numeracy difficulties are widespread in the adult population. In the government's 2003 *Skills for Life* survey, 15 million adults were estimated to have numeracy skills at or below entry level 3. Of these, 6.8 million had skills at or below entry level 2. An online survey of 2,006 adults aged 18 and above, conducted in 2008 by YouGov for the Every Child a Chance Trust^v, found that 'more than one in four adults admitted they had difficulties with mental arithmetic, and over a quarter sometimes struggled to add up prices in their heads when shopping. Nearly half (47%) wished they had learnt more maths at school and just over half (51%) of mothers said that they struggle to answer mathematical questions which their children ask them. One in five adults in the 25-34 age range felt that greater ability in maths would have helped them get further on in their careers. Women were much less confident than men – 34% said they had trouble working out sums in their heads, compared with 18% of men.' Research shows that in many cases numeracy matters more than literacy^{vi} – this is particularly true for women. Those with poor numeracy are less likely to be in a full-time job at age 30. They are also less likely to be in any form of paid employment (including part-time), and more likely to be engaged in home care. 'Recent surveys show widespread concern amongst employers about their employees' basic skills. The CBI's 2008 audit surveyed 735 firms employing 1.7 million people between them. Over half said they were concerned that they will not be able to find enough skilled people with the right qualifications in future. They had serious concerns about employees' ability to spot simple numerical errors, write in sentences, spell correctly and use accurate grammar. Some 40% of employers reported poor customer services and 34% lowered productivity as a result'^{vii}.

Numeracy is the focus for much of the recent policy. The Leitch Review of Skills^{viii} proposed stretching targets – 95% of adults achieving functional numeracy (*Skills for*

Life entry level 3) by 2020. The Leitch recommendations have been accepted and World Class Skills^{ix} has set milestone targets – 81% of adults to be qualified to at least entry level 3 numeracy by 2011. The demanding 2020 numeracy target is seen as more of a challenge than the target for literacy and it is recognised that a specific drive on numeracy is required.

Despite the economic drivers to improve the numeracy skills of adults, many providers report that numeracy learners are more difficult to recruit. The National Research and Development Centre (NRDC)^x has researched some of the reasons why adults are reluctant, and reported that numeracy learners have more negative compulsory school experiences than literacy or language learners. Learning environments that remind learners of past experiences are especially demotivating. Some surveys identifying need have found adults often describe their skills as adequate when, by international standards, they are weak. Such surveys often ask general questions about numeracy ability but when they ask specific questions about their ability to perform operations such as multiplication and division more adults will declare difficulties. Respondents' reluctance to report general problems with numeracy indicates that many people believe that despite some specific problems such as division, their overall numeracy ability does not present significant hurdles, even when those skills are, by international standards, very poor.

Motivating such individuals to improve their numeracy is a significant challenge, and is likely to be less straightforward than motivating learners to improve their literacy^{xi}. From recent research^{xii} we now know that adults are often motivated to take up numeracy learning opportunities for one or more reasons. These include a desire to help their children or grandchildren with their school work and to avoid the kinds of unpleasant experiences they themselves had at school, to experience success in a subject which is seen as a signifier of high intelligence or to gain a qualification for either personal satisfaction or as a passport to further learning, employment or better employment opportunities.

Museums, libraries and archives have made considerable strides in developing their contribution to improving the basic skills of people from their local communities. Working with partners they are in a unique position to attract and support potential learners to provide a non-threatening, engaging learning environment. The 'Inspiring Learning for All Framework' provides both an organisational- and individual-focused outcomes framework. Generic Learning Outcomes (GLOs) provide a language and a structure to demonstrate to partners and funders the unique contribution that museums, libraries, and archives make to the learning agenda. GLOs provide data to demonstrate effective learning which fits well with the current emphasis on tracking participation, achievement and encouraging progression.

The ESF-funded 'Libraries for Learning'^{xiii} project in London used some of its resources to set up an Innovation Fund to support the development of new learning activities for local people with *Skills for Life* needs. The success of the project depended on a number of factors which included building on and developing the London Libraries *Skills for Life* compact. This provided a framework for making improvements to *Skills for Life* services in libraries, increasing *Skills for Life* awareness for museum staff, engaging development workers to spread good

practice and support developments, establishing partnerships and developing procedures for referral and data collection (to demonstrate learner progression). Much of the provision focused on literacy and language development; however, the recommendations from the report should inform work on the numeracy agenda:

- Move forward with the *Skills for Life* Compact framework in each authority, including a formal *Skills for Life* infrastructure.
- Signposting and Information and Guidance (IAG) services need to be developed to enable library staff to refer enquirers about *Skills for Life* classes.
- New programmes should be devised to target *Skills for Life* learners, for example organising tours for local *Skills for Life* classes.
- Provide more *Skills for Life* awareness training for staff.

Museums, libraries and archives have a strong tradition of working with families, and learning opportunities for children are generally better established than those for adults. The NIACE MLA publication *Families, learning and culture – Inspiring families through museums, libraries and archives* (2008) outlines the policy context and strategic challenges alongside details of examples of the good practice in the sector.

Example

Norfolk Castle Museum's Learning Department has worked in partnership with the Norfolk Family Learning team to plan and deliver a nine week family numeracy course, every year since 2006. As an extended course, it is particularly special for the museum, giving them the opportunity to get to know the participants well and to make them comfortable with the museum environment. In the mornings, adults and children work in separate groups, the adults preparing for the national numeracy test which they have the option to take at the end of the course, and the children improving their numeracy skills with group and individually tailored work. In the afternoons, the families come together and work with museum educators on numeracy themed activities based on and with buildings, galleries and objects from the museum. Activities include working on arithmetic and times tables with a 'Victorian schoolmaster'; collecting and recording data about the numbers of different kinds of amulets, gods and figures in the Egyptian collection; and measuring the castle keep using a chain¹.

This example shows a very positive approach to making adults feel comfortable about their learning environment, and acknowledges the need to develop professional relationships with them while their children are also learning. The approach developed for family learning and the activities for adults could be replicated for dedicated adult numeracy provision.

3. Methodology

MLA asked NIACE to work with museums and archives to:

1. Scope in 4 regions existing activity in museums and archives that engages adults in numeracy activities. Regions identified – London, East of England, Yorkshire and Humberside and the North West.
2. Identify good and interesting practice in this respect.
3. Develop a number of case studies worth sharing.
4. Identify opportunities for museums and archives to make a greater contribution to engaging adults in activities which could develop their numeracy skills.
5. Identify capacity building needs within the sector and to make proposals as to how these might be met.

The NIACE Development Officers (DOs) for each of the four regions approached their contacts and networks to request examples of adult numeracy activity within museums and archives. In three of the regions, DOs had a good network of contacts based on previous collaboration between MLA and NIACE. In the North West, contacts were identified using the Group for Education in Museums (GEM) network.

The term numeracy will be used throughout this report, except where references use the term maths or mathematics. Readers should be aware that the different terms have different connotations to people. For some adults numeracy may be seen as a more positive term than maths but the opposite may also be true. We need to be aware that language can trigger powerful emotions in adults.

4. Existing numeracy work in the regions

The scoping exercise has revealed many interesting examples of numeracy activity within the museum and archive sector. Although the majority are child-centred and suitable for family learning activities there is much that can be transferred to the adult context. One such example is of taster activities designed and delivered in collaboration with Norfolk Family Learning Service and local schools:

Example

Gressenhall Museum, Norfolk has an activity that involves taking photographs around the museum which is an old workhouse. They are then developed and printed in the school darkroom. Developing the prints includes a great deal of practical numeracy.

This is a good example of how numeracy can occur naturally as part of the activity; it provides an opportunity to discuss volume measurement and reading scales that could be made explicit in the activity. The importance of accurate measuring is demonstrated by the quality of the developed photographs. Understanding measurement and scale by physically measuring liquids is suitable for those learners

who enjoy practical activities. The activity is not just constructed for the classroom; it is what used to happen before the digital age and most importantly it is fun with a product to take away.

When adults start to learn, many are persuaded to persist if the learning is relevant to their own lives or is in itself intellectually stimulating and satisfying. It is not essential that the learning has an immediate 'payback' in the sense that the learners can now do something in their everyday lives more effectively, although this does often bring satisfaction and strengthen the desire to continue learning. Sometimes, however, the payback is simply intellectual pleasure gained from exploring mathematical ideas.

From our initial scoping, there were, with some notable exceptions, fewer examples of numeracy activities linked to archives than to museums. In one such example, the archives team in Hertfordshire formed a partnership with local studies and lifelong learning librarians to provide an effective means of bringing local records to life and illustrating how archives can be used. Records from the Victorians in Hertfordshire are used for a family learning project:

An activity event developed from the Victorian archive records from a local tailor's shop. The records include pattern books, swatch books and records of a royal visit to Bishops Stortford in the 1850s. Families explore literacy and numeracy skills when using the archive patterns. Family Learning activities include using records to design costumes, dress a paper doll and design a frieze with the models along the route of the royal visit.

Families, Learning and Culture 2008^{xiv}

An example of embedded numeracy: exploring shapes, patterns and symmetry. The hook for learners is being involved in designing clothes and comparing old and new methods as well as the costs then and now.

5. Promising practice

There is no 'one size fits all' approach to the effective teaching of numeracy, but there is a growing consensus amongst numeracy educators about a set of principles derived from two key strands of research. The 'Thinking Through Mathematics'^{xv} project spelled out eight research-based principles for effective teaching practice, and work by Black and Wiliam^{xvi} added a ninth.

1. Build on the knowledge learners bring to sessions.
2. Expose and discuss common misconceptions.
3. Develop effective questioning.
4. Use co-operative small group work.
5. Emphasise methods rather than answers.
6. Use collaborative tasks – rich tasks.
7. Create connections between mathematical topics.
8. Use technology in appropriate ways.
9. Use assessment formatively.

Together these paint a picture of active learning, with the learner actively involved in exploring ideas and in thinking ideas through. Project-based work using the kinds of

resources that are available in museums and archives offers very rich opportunities for exactly this kind of learning experience. Some of the practice we have heard about does encourage active learning and it is likely to be challenging and stimulating for learners. This is more likely to be successful than projects based on more routine worksheets. Without further investigation to observe how materials are used, we are not able to make definitive comments on genuine good practice included in the following examples, although many of the activities look very interesting.

The following codes have been used to identify provision from the scoping exercise for different groups. Although, as previously mentioned, many, if not all, of the activities could be adapted for adults, it is the approach of the tutor or museum and archive staff that would have to be appropriate for adult learners rather than the actual activity.

Adult provision	Provision developed for schools	Family learning provision
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Interesting practice that it should be possible to adapt to any museum setting

We have identified numeracy topic areas that are not directly referenced to either the adult curriculum or the national curriculum and have provided example activities from museum settings from the scoping exercise.

Numeracy topic areas	Example Activity	Organisation
Conversion of different systems <ul style="list-style-type: none"> • Currency – this could also include budgeting • Weight measurement • Distance measurement • Volume measurement • Ratio 	Money conversion activities using a till from 1910 and the currency convertor from the national archives website.	Tullie House Museum in partnership with Cumbria Family Learning
	Money activities in the World War II shop.	Time and Tide Museum, Great Yarmouth
	World War II collection.	Hitchin British Schools Museum
	Looking at wages of children in Victorian times.	National Coal Mining Museum
	Fast Food from the Past – the course is focused on the Roman collections and includes the development of recipes. Numeracy activities included weighing, rations, graphs, cost, measuring and carrying out surveys, and using data to evaluate success.	Norwich, Cromer and Thetford Museums in collaboration with Norfolk Learning Partnership
	ESOL and numbers sessions – using coins and medals from collections to record information such as dates and values while also developing language	British Museum

Numeracy topic areas	Example Activity	Organisation
	through discussion.	
	Adult Learners' Week sessions based on coinage and numismatics.	Letchworth Museum
Estimation and measuring of dimensions of museum buildings and artefacts This could include: <ul style="list-style-type: none"> • Length • Radius, diameter, circumference • Area • Volume 	Measuring the depth of a well, calculating how much water it would hold and how long this would last during a siege; and measuring the castle walls and considering ratio and scale factors when comparing actual measurements with a scale model of the castle.	Norwich Castle Museum
Negative numbers, ordering numbers using: <ul style="list-style-type: none"> • Timelines 	Workshops designed around 'When was the castle built? When did the Romans come to Norfolk? When did they leave?' etc.	Norwich Castle Museum, Tullie House Museum, Cumbria
Shapes, patterns and symmetry of: <ul style="list-style-type: none"> • Buildings • Mosaics • Textiles • Natural history collections 	Tour of the site looking at shapes and symmetry, number patterns and proportions as well as a triangle trail designed to find shapes around the museum.	Weald and Downland Open Air Museum
Strategies Examples of old board games – leading to consideration of strategies for addition, subtraction and other arithmetic operations.	Worksheet on 16 th century arithmetic.	Weald and Downland Open Air Museum
Museum trails with numeracy questions	The trails can be used to help improve mathematical thinking, not just observational skills. The questions can provide opportunities to explore and develop strategies for solving a variety of problems.	Colchester Castle and Colchester Park
	A family trail based around numeracy.	Tullie House Museum with

Numeracy topic areas	Example Activity	Organisation
		Cumbria Family Learning
Use of weapons – consideration of trajectories and angles	Possible development of family events with a maths element including activities such as building a round house, building and firing catapults etc.	Colchester and Ipswich Museums Service
Map reading, co-ordinates, scale drawings, proportion and ratio	Workshops using sand trays to bury archaeological objects which are then dug up and co-ordinates recorded.	Norwich Castle Museum
	Activities such as measurement, Pythagoras' Theorem (to get a right angle when laying out a grid) drawing things to scale and similar activities.	The Young Archaeologists Club at Mill Green Museum and Mill
Activities of a general nature where numeracy can be embedded	Working with a local special needs school to develop a medieval themed garden. As part of this project pupils have surveyed the area, drawn plans, recorded archaeological finds and developed designs for the garden. (2005/6).	English Heritage and Rievaulx Abbey Courtyard Garden

We have seen examples of well-produced booklets for adults with a selection of literacy and numeracy activities and worksheets.

Welcome to Wakefield Museum – a resource on adult literacy and numeracy for teachers and learners inspired by the museum's collections.

<http://www.mylearning.org/overview.asp?journeyid=450>

Numeracy Trail in Hull – the basic skills resource and staff development centre in Hull have developed a series of booklets of integrated literacy and numeracy activities related to different museum collections in Hull, e.g. Down at the Deep (the world's only submariam) and Travel Through Time at the Street Life Museum of Transport. The booklets use facts, comments and pictures about the museum to help people brush up on their basic skills. They are suitable for use with adults in numeracy classes visiting the museum. The questions are clearly linked to the national curriculum and can be used as a file of evidence for accreditation.

Victoria Baths Manchester – an online quiz for adults linked to an adult learner pack containing literacy and numeracy activities.

<http://www.waterpalace.org.uk/?tok=1>

The 'Learning Maths outside the classroom' project (funded by the Department of Children, Schools and Families [DCSF]) has produced an extensive set of resources for learners and CPD activities for school teachers. All are available at

<http://www.ncetm.org.uk/Default.aspx?page=13&module=res&mode=100&resid=9268>

Hard copy publications aimed at the school sector

- *A Teacher's Guide to Maths and the Historic Environment*, Tim Copeland, English Heritage.
- *Maths and History*, A Maths 2000 booklet, Essex Records Office.
- *Maths Year 2000, Ideas for Museums, Galleries and Heritage Sites*.
- *Creative Minds*, MLA Yorkshire, a guide to support the development of mathematics and numeracy in museums, libraries and archives. March 2006.

We are aware that there is some excellent work taking place at the National Museum of Science and Industry – Dana Centre, the National Maritime Museum at Greenwich and the Wellcome Trust – but we have not as yet been able to establish contact with them.

Interesting practice that it should be possible to adapt to any archive setting

Similarly we have identified numeracy topic areas that are not directly referenced to either the adult curriculum or the national curriculum and have provided example activities from archive settings from the scoping exercise.

Numeracy topic areas	Example Activity	Organisation
<p>Data collection, recording and analysis This could also be undertaken in any museum setting but would work particularly well with archive collections</p>	<p>A series of activities based on resources chosen for their interest and local relevance. The resources include census data, old maps, a Victorian schoolboy's account book and population tables. The activities include constructing tables and graphs, reading and interpreting data and learning about co-ordinates in order to:</p> <ul style="list-style-type: none"> • Find out about the past from census returns. • Use maps to explore how the local area has changed. • Find out what it was like to live in the local area in the past. 	<p>Essex Records Office</p>
	<p>The Victorians in Hertfordshire project. Case study 3</p>	<p>Hertfordshire Archives</p>
<p>Problem solving Using archive information about real events or activities</p>	<p>An activity based on the Tring epidemic in 1899. Case study 3</p> <p>Astronomical records of the 18th century.</p>	<p>Hertfordshire Archives</p> <p>York City Archives</p>

Numeracy topic areas	Example Activity	Organisation
	Case study 4 Other medical collections have been used to explore the spread of disease and population change.	
Activities based on specific resources such as census data, population data, maps, account books and similar.	Time Detectives – looked at a local community and studied the statistics to explore the impact the Great War had on the community. They gathered data from primary sources including war memorials, period newspapers and museum collections. See case study 5.	Beck Isle Museum

Activities built upon the specific features and exhibitions of individual museums

We have identified some museums that have collections that lend themselves to specific numeracy activities.

The Time and Tide Museum in Great Yarmouth is based in an old curing works full of racks for smoking fish. This offers opportunities to develop numeracy activities around the quantities of fish which can be cured, the wages of staff, the dimensions of the racks and chimneys etc.

The Time and Tide Museum in Great Yarmouth is based close to the site of the new outer harbour development and is planning an exhibition on this topic. There are many opportunities to develop activities which compare the features of the old and new harbours. These could include measurements of:

- The size of the harbour.
- Length of journeys.
- Perimeter, area, depth and volume of vessels.
- Size and fuel consumption of vessels.
- Hours work and site and wages to be paid.
- Volume/weight of earth removed/ballast imported in order to build the harbour.

They could also include activities based on time such as:

- Recording the journey time of vessels and comparison with air travel.
- Reading timetables of sailings.
- Exploration of tables of tide times and comparison of seasonal changes.

Activities centred on shape and space could include:

- Drawing plans of the harbour.
- Using scale plans.
- Using ratios to calculate changes.

Norwich Castle has developed a one-day problem-solving event, *Storming the Castle*, based on a real siege which took place in 1215. Case study 1.

At the Transport for London Museum and possibly at other transport museums, activities around speed, efficiency and cost of different vehicles and modes of transport, journey planner website for map-reading, estimated journey times and ticket prices. Map-reading, navigation techniques and the study of wheels could all be brought in.

Travel through time at the Street Life Museum of Transport, Hull. The booklets use facts, comments and pictures about the museum to help people brush up on their basic skills. They are suitable for use with adults in numeracy classes visiting the museum.

Museums with relevant collections such as Egyptian or World War II will be able to develop activities relating to codes, code-breaking and hieroglyphics. Dover Castle offers secret codes and ciphers workshops using World War II equipment.

Weald and Downland Open Air Museum has developed a worksheet based on Lurgashall Mill. It investigates the structure of the mill power train and gearing ratios. Similar activities are offered at Mill Green Museum and Mill in Hertfordshire.

Roman collections can support the study of Roman numerals, measurements, surveying techniques, building plans and designs, Roman roads and Hadrian's Wall.

Sir John Soane Museum enables members of the Community of Bethnal Green to develop their numeracy skills through the use of digital cameras and technology.

The Royal Game of Ur – the oldest game board ever discovered was found inside the royal tombs at the ancient Sumerian city of Ur, Mesopotamia. The game is on display at the British Museum. You can play the game online at the British Museum's [Mesopotamia](#) website.

The British Museum has a touring exhibition which includes the Rhind Mathematical Papyrus, a mathematical 'text-book' from the 16th century BCE. The papyrus discusses a wide variety of mathematical problems, including work on fractions and algebra.

6. Resources / ideas bank

While there are many different resources and websites, there appears to be no single website or portal where numeracy activities are available to be shared. A single point to store an 'ideas bank' of activities that have been developed, tried and tested with the associated teaching resources could have enormous benefits. A repository such as this would support museum and archive staff and their partners to sustain their efforts and optimise development time. As much as it would be useful to have all the information in one place, careful consideration will need to be given to

key words so that the search facility is informative. Appendix 1 contains web links and references to hard copy materials collected throughout the scoping exercise.

7. Challenges

Organising learning for adults in the sector can pose some specific challenges:

7.1 Physical environment

Museum rooms and spaces are not always available and the spaces themselves do not always provide a suitable setting for group-based learning activities. This is a real issue for museums that already do significant amounts of work with schools, leaving little or no space for work with adults. There can be health and safety issues for courses involving young children (such as Family Learning courses). However, the physical environment can provide opportunities for developing activities that can't be done in the classroom and which make creative use of museum buildings and resources.

7.2 Working in partnership

Partnerships are key to success in many of the examples identified in the scoping exercise, but collaborative initiatives take time to plan and develop. Many museums and archives do not have the staffing resources to attract and recruit adult learners and are therefore reluctant to develop provision without being sure of the demand. Great Yarmouth Museums are a typical example where they only feel able to plan in response to specific requests as they have little speculative development time included in their current posts. Partners, including statutory and voluntary community providers, may have resources to contribute towards the recruitment of learners and providing teaching.

7.3 Funding

Some of the large museums have the venue and access to staff or consultants with the expertise to carry out the development work for adult numeracy activity but what they do not have is the money to pay the consultants or to provide essential learner support such as crèches, learner travel etc.

Where specialist expertise, such as information, advice and guidance, cannot be provided by museum and archive staff, partnerships have to be developed, and there is a cost in the associated staff time required to do this. The 'Libraries for Learning' project in London used development workers successfully to broker partnership development. The Open Doors project in Yorkshire and the Humber is another example. Where interest in numeracy has been developed through stepping stone activity there is a need to signpost on to further learning. Links and partnerships need to be developed so that information, advice and guidance is timely and appropriate. Again, development workers in London's 'Libraries for Learning' supported this process.

7.4 Infrastructure

In general, activities based on archive materials have appeared less well-developed than in museums. However, we have included some exciting examples and these could be replicated at other venues. Some archive staff could benefit from

opportunities to develop their knowledge of the education system or of teaching methods in order to help them to see the potential of archive sources for numeracy work at different levels of education. There needs to be dedicated time and staffing capacity on the part of archive staff to exploit the potential of their collections in relation to numeracy.

7.5 Audience

This is a challenge that faces all those working to encourage adults to improve their numeracy skills – namely, can museums and archives attract adults with numeracy needs into their buildings? On the basis of the regional scoping, it is concluded that family learning may be the best way of raising awareness with adults that numeracy skills matter. Another approach may be to extend existing activities; some museums are already doing this with subject areas that attract learners. There are some disadvantages with this approach as existing learners may not have poor numeracy skills or they may be reluctant to improve them. The challenge is to make the numeracy elements explicit and to ensure that the numeracy activity is fully supported and not just a bolt-on activity.

Experience has shown that activities containing the term ‘maths’ are often a disincentive. Imaginative titles help with recruitment. In the scoping exercise there were some good examples of imaginative titles to raise interest: ‘The Royal Game of Ur’.

Other approaches to engage adults could involve adults in taster activity; this may then generate interest and learners could be signposted to further learning such as ‘if you found this interesting you may want to try...’ Although there is less scope for workforce development around numeracy support, there may be some potential to address employability skills by offering alternative and pleasant venues for people undertaking employability training. While some museums feel able to develop the activities themselves, others will need to work in partnership with other organisations. Partnerships of some form will be crucial in all cases if effective progression is to be ensured for learners.

7.6 Added value

Making the most of every opportunity to ensure sustainable growth within the sector is important; the *Skills for Life* infrastructure needs to be permanent and not built on projects that have a limited life. Local Area Agreements (LAAs) are the agreements used to reflect key local priorities using a national indicator set. Visits to museums and galleries are a priority in only a few local authorities. However, the indicator for adults involved in arts events, either by attending or participating, has been selected for inclusion in the LAA by 16% of local authorities. Participation in an arts event could include informal learning activities, which may also contribute to other national indicators and local priorities, for example, in the areas of improving adult skills, raising achievement, addressing disadvantage and community cohesion. This highlights the potential for the sector to show how it can add value to a variety of other agendas, and particularly for those museums in the voluntary and private sectors, to make effective links with the local planning process.^{xvii}

7.7 CPD needs of museum and archive staff

In contrast with the developments in supporting literacy, improving numeracy skills may be more of a challenge for the sector. It cannot be assumed that staff have the confidence and numeracy ability to support potential learners. Their attitudes and skills will reflect to some degree those of the adult population at large and it is clear that many people (of all professional levels) are fearful and lack confidence when asked about their numeracy ability. Awareness raising and support for staff is essential and should include learning about:

- The impact of poor numeracy skills on adults' lives and the sensitivities that many adults have that are rooted in their past experiences.
- Informal approaches to assessing the confidence of museum and archives staff in their own numeracy skills and attitudes.
- Consideration of the different numeracy levels so that when resources and activities are considered they are developed for suitable ability levels. It may be that a narrow range such as entry 3 to level 1 may be the most appropriate level to pitch activities initially.
- Examples of how exciting improving numeracy skills can be and the importance of speaking and listening.
- Examples of effective ways of improving the numeracy skills of adults using museum collections and archive resources.
- The principles of good maths teaching and general teaching techniques.

In other sectors, awareness raising has been a task that has never been completed, as staff turnover means that there is always a need for more. It could easily become an activity that is abandoned in difficult times, thus risking the sustainability of the whole agenda. Ensuring that maintaining awareness is included within job descriptions would reduce some of the risk of losing expertise among museum and archive staff who could with time and experience deliver awareness activity themselves.

From the scoping exercise we deduced that different parts of the sector had varying experience in developing learning opportunities, therefore different staff development interventions after the initial numeracy awareness will be needed in order to build the capacity of the sector as a whole.

Museum staff

Many venues have experience developing and delivering learning opportunities either with schools or family learning. They would benefit from a numeracy expert working with them to explore numeracy possibilities and tease out where numeracy is hidden in existing activities. In order to meet the needs of adult numeracy learners, museums may be best advised to work in partnership with a provider from the FE sector with experience of delivering *Skills for Life* or in collaboration with a Family Learning Service or extended school.

Archive staff

From the scoping it would appear that archive staff have a greater learning journey to undertake – apart from some exceptions highlighted in this report. Allocating a

museum education officer with a teaching background to work with archive staff to identify the potential of archive sources for numeracy work at different levels of education would be beneficial. Providing an opportunity for archive staff to work in partnership with those directly involved in delivering numeracy to enable them to 'bounce ideas off each other' and to develop a 'product' which plays to both the numeracy content and the archive material would be beneficial to both partners. It is also important that archive staff increase their awareness of the needs of adults with complex disadvantages and they should have an opportunity to develop their personal skills and understanding to enable them to work with hard to reach adults and families. The awareness and skills can be developed through partnership working with those who do have an appreciation of these needs.

Tutors

Numeracy tutors working in museums and archives need to have an appreciation of the collections and records alongside an enthusiasm to adapt and develop activities and resources. Working with archive staff they need to ask a defined question. This report is already generating some of the ideas for archives, and current TV programmes such as 'Who do you think you are' are generating an interest in family histories. Rather than asking vague questions such as, 'Have you any data we can use in the classroom?', what needs asking is something more defined such as 'What data do you have on Harwich/persecution of witches/what a Victorian schoolboy spent his money on?' etc.

Organisations and individuals will need different combinations of the above dependent on their job role and purpose. To underpin the development there should be processes and procedures to support staff and learners including:

- Developing the offer, course development and funding available.
- Making resources readily available.
- Good practice examples readily available.
- Signposts and information for learners to progress

8. Conclusion

Our impression is that while there are lots of good examples, overall development of the numeracy provision for adults is patchy and there is a case for raising awareness about numeracy. There may be an institutional or individual lack of awareness about what the sector is doing or can achieve in this respect. Numeracy can be found within many topics and this needs to be made explicit by museums and archives. The sector has a huge potential for encouraging adults to improve their numeracy, building upon the extensive work with schools and the growing work with family learning. Both these areas provide a good basis to develop further opportunities for adults. However, there needs to be a systematic process of development, from capacity building of museum and archive staff supporting them to develop their mathematical confidence and skills, to forming partnerships, establishing processes and procedures and most importantly providing funding.

9. Recommendations

We recommend the MLA draws up an action plan for developing numeracy activity, which includes:

1. Commissioning guidelines for museums and archives to develop numeracy activities, with reference to existing good practice examples. The guidelines could include: identifying audiences, considering the role of volunteers, finding partners for delivery, how to make numeracy visible, signposts to good practice, sample activities and a checklist based on effective teaching and active learning.
2. Identifying appropriate funding sources to support numeracy development activities, including funding to develop collaborative work with partners.
3. Considering establishing a single or key portal onto which information on numeracy can be uploaded. This would include an ideas bank so that good ideas are not lost. This could potentially reduce development time when shared nationally. Careful consideration would need to be given to key words so that the search facility was informative.
4. Commissioning CPD programmes and considering plans for sustaining the expertise within the sector in line with suggestions above.
5. Ensuring that resources generated through CPD activities are shared via the single key portal.
6. Commissioning a set of resource packs around topic areas, building on the good examples available specifically for work within archives.
7. Ensuring that resources produced are mapped to the key stages and adult curriculum, GLO and family education good practice guidelines.
8. Guidance for staff to adapt activities and materials originally designed for children for use with adults.
9. Establishing a priority focus for numeracy and key audiences to be targeted. This may initially be those with skills between *Skills for Life* entry 3 and level 1.
10. Undertaking market research with current customers to stimulate interest in maths.
11. Each region to hold a dissemination event to showcase good practice in numeracy.

10. Case Studies

Case study 1

***Storming the Castle* – Norwich Castle Museum in collaboration with the Norfolk Schools Service**

The 'Storming the Castle' project challenged the idea that museums are not places where schools can extend their students' maths skills. On the contrary, the project demonstrated that museums can offer inspiring buildings, wonderful collections and lots of hands-on, interactive experience – all of which can inspire and stimulate maths-related enquiry.

The event was able to accommodate 120 students and was structured so that all participated in the same activities. However, some were assigned roles as defenders and others as attackers of the Castle, a mixture which created opportunities for lively debate within the groups. The day was based on an actual siege of the Castle which had taken place in 1215, thus giving the event historical authenticity. There were four activities and each group participated in all of them over the course of the day. Activities were based on the Castle building and its collections, and had a clear maths focus. They were also designed as interactive sessions.

One activity was based on weapons and armour. Using a collection of weaponry and armour, students explored how effective these could be for attacking or defending. For instance, how many arrows could a soldier fire in a minute using a longbow as opposed to a crossbow? Which weapons would be better for attacking and which for defending? Using a 'chain mail' shirt, students estimated its weight and also how many individual links it took to construct it. They were also able to try on some armour, estimate its weight and work out the ratio of the weight of 'soldier' to the weight of soldier's 'kit'.

Students also looked at coinage. As attackers and defenders, all were given lists of costs for different equipment and resources (such as food and drink and soldiers' wages and armour). They were also given a budget to spend as effectively as possible and so had to make decisions about what they could afford and what they would do without. They also had a go at coin striking to produce their own coins. In the Castle basement, which in medieval times had been the area for storage of food and the place where the well was located, students focused on food storage, water and a tactical game. They were given a plumb line to measure the depth of the well and to decide how much water it would hold (and therefore how long the inhabitants could withstand a siege). They handled authentic medieval objects to see what kind of storage capacity these represented and they played the game 'Fox and Geese', a medieval strategy game of attacking and defending.

The activity in the Castle Keep gave students the chance to collect data for follow-up work at school: the data included many measurements of the Castle (and the scale model of it), such as the height of the windows. Back at school, work would be done

on mathematical ideas such as angles, trajectories of arrows, and ratios relating to different parts of the building.

For the students, the day had been about purposeful and engaging activity related to problem-solving; they had had the chance to explore the Castle and its collections in a way that enabled them to think about the maths required to develop a strategy to either withhold a siege or to mount an attack of a fortified building – an experience students would not normally have in a maths class.

Case study 2

Family Numeracy course – Norwich Castle Museum in conjunction with Norfolk Adult Education Service

This numeracy course for parents or carers and their children took place in the Castle over a nine week period. The course led to national qualifications in numeracy. In the morning the adults and children worked in separate groups which came together in the afternoons to work on numeracy-themed activities based on and with buildings, galleries and objects from the museum. The first session involved a tour of the Castle followed by questions. The majority of these tended to be numerical – ‘How much?’, ‘How long?’, ‘How big?’, ‘How old?’, ‘How many?’ – and formed the basis of themes which were developed in subsequent sessions.

Themes such as estimation and units of measurement ran across all the sessions. Other topics covered included: history and time – (BC and AD); weights and measurements; money; data collection; recording and analysis; estimation skills; arithmetic and mental maths skills.

The Victorian collection of toys, household and school-related objects lent itself well to working on arithmetic, times tables and memory work under pressure from a Victorian schoolmaster.

The Castle Keep was used both inside and out. Families used old measurements (including using a real chain) to measure and look for patterns in the keep design. They used points of the compass to describe features of the keep and the session was followed by a tour of the battlements.

The Egyptian collection was used to collect and record data about the numbers of different kinds of amulets, gods and shabti figures in the collection. The replica Rosetta stone was used to introduce codes and code breaking. Everyone wrote his or her name in hieroglyphs.

Other activities included: shape tessellation and tangrams in history and around the museum; shapes in modern art; units of measurement in Saxon and Norman England; estimating and measuring the depth of the Castle well; identifying artefacts and sequencing in timelines; Roman weapons and numerals; designing and making a family game with museum quiz cards.

Case study 3

Victorians in Hertfordshire – an online resource of archive resources and related activities developed by Hertfordshire Archives and Local Studies and several Hertfordshire schools

This resource, which was created with the support of funding from the Department of Education and Employment (DfEE), can be found at <http://www.thegrid.org.uk/learning/hals/victorians.htm>. It consists of three parts, each of which contains a database of digitised sources including ordnance survey maps, the 1891 census returns, newspaper articles, photographs, official documents, directories, advertisements and other local records and transcripts. There are also tutors'/teachers' notes and learning activities.

Epidemic Tring 1899 consists of a structured interactive programme which takes learners, acting as members of the Urban District Council of Tring, through the process of responding to and managing an outbreak of typhoid in August 1899. A series of timed 'telegraph' messages arrive online over one day representing the five months duration of the epidemic. The first few set the scene, give information about the weather and related drainage and sanitation problems and introduce the main players. Subsequent messages provide more information about the epidemic and an update on numbers of sick, numbers of deaths and what is being done to manage the epidemic. There is also a database of over 150 sources from a variety of documents. There are also guides to using the database, to searching and filtering the spreadsheets of the 1891 census and other teaching and learning resources and ideas.

Hoddesdon High Street 1890s involves learners investigating some of the ways in which the local area has changed using a database of sources including the 1891 census, photographs, directories, maps, newspaper articles and advertisements. The teaching and learning resources provide guidance for teachers and tutors and suggestions for activities. These include structured investigations such as: 'What can we learn from looking at Hoddesdon High St about women's lives in Victorian times?'; 'Is it true that married women in Hoddesdon did not work? Trace the story of Mary Rainbird to test this out'; 'Did families have more or less children than the average today? The census does not record those children who were no longer at home or who have died so it is difficult to get accurate numbers of family size from the census. Look at the case of the Miles family who ran the Bull'; 'What happened to Emily Elizabeth Draper?'

Stevenage 1890-1900 investigates what life was like for people in Stevenage at the end of the 19th Century and how political, industrial and rural changes affected people's lives. The database is made up of over 200 sources including census returns, parish and farm records, maps, directories, photographs, newspaper articles, Board of Guardians and medical records, school logbooks and local committee papers. The learning activities involve structured use of census data to investigate issues such as: problems of overcrowding; the differences in circumstances between individual families living in the same street; inward migration

from other towns, counties and countries; the extent of evidence to suggest that Stevenage was still very much a rural area even though it became an Urban District Council in the 1890s.

Case study 4

York City Archives and astronomical records of the 18th century

York City Archives developed a series of lectures for two local specialist school sixth form groups. The lectures focused on the achievements of past astronomers, particularly the accuracy of their measurements, recording and calculations. One lecture led by Martin Lunn (from York Museums Trust) explored astronomical observations of the late 18th Century and their importance in the history of astronomy. The observations (archive material) of York astronomers Goodricke and Pigott were discussed using archive material from York City Archive. These observations included studies of comets, early observations of the planet Uranus and most importantly detailed observations of the variable star Algol and its unique interpretation as an eclipsing binary star. Another workshop entitled 'From Aristotle to Einstein' explored the development of theories of the universe that led to the concept of orbital motion and its importance in our understanding of nature. This session also considered how observations of the motion of the planets led to empirical laws that were later explained by the physical/mathematical theory of Newton and the observations of the planet Mercury that led to the new theory of gravity developed by Einstein.

This project stemmed from the Creative Minds Project Supporting STEM mathematics and numeracy in museums, libraries and archives using funding from the Regional Development Agency. This project is now completed.

Case study 5

Time Detectives – More than Statistics

The idea for this Creative Minds funded project led by Beck Isle Museum, Pickering, Yorkshire was to take a local community and study the statistics and impacts that came from the Great War and the lasting effects within the community. The data was gathered from local primary sources including war memorials, period newspapers and Green Howards Regimental and Beck Isle Museum's collections. The project was developed in partnership with Kirkbymoorside School.

Using these resources pupils studied:

- How many men/women fought in the Great War from the community?
- How many returned?
- For those who did not return what was the cause of death? (Were they killed in action, died of other causes, died of wounds, remained missing, wounded and so on.)
- The impact of the numbers that did not return.
- Who were the youngest and oldest local soldiers?
- What were the main units local men served with?

Scientific developments that changed warfare during the period, and what life in the trenches was like for the British 'Tommy', were explored through museum visits along with hands-on sessions.

Pupils recorded information from local war memorials; this also helped to encourage students' interest in their local monuments and their parish church. Although the project focused on Science, Technology, Engineering and Maths, aspects of citizenship and community belonging were developed. The students constructed an Excel database which can be used to extract and interrogate the data and look for patterns. This database will be further developed so that other schools and the museums can use it.

This project stemmed from the Creative Minds Project Supporting STEM mathematics and numeracy in museums, libraries and archives using funding from the RDA. This project is now completed.

Appendix 1

Resources and ideas bank collected during the scoping exercise:

- www.mylearning.org – free learning resources for MLA Yorkshire and the Humber had 1 numeracy resource, 4 maths resources and 19 science resources.
- www.mlay-skillsforlife.org.uk – the website of the *Skills for Life* in Yorkshire and the Humber MLA Open Doors project.
- www.ncetm.org.uk – the National Centre for Excellence in the Teaching of Mathematics (NCETM) aims to raise the professional status of all those engaged in the teaching of mathematics so that the mathematical potential of learners will be fully realised.
- <http://www.thegrid.org.uk/learning/hals/victorians/htm> – teaching resources using archive data from Herefordshire.
- www.measuringworth.com/calculators/ppoweruk/ – used to translate prices from any chosen time in history into today's prices. It could be used to develop exercises relating to account books, bills and similar documents likely to be available in archives.
- <http://www.24hourmuseum.org.uk/> 24 Hour Museum (24HM) is a government-funded website promoting museums, galleries and heritage sites across the UK.
- 24HM's children's zone www.show.me.uk, by a not-for-profit organisation called Culture24. The site is produced by a small team of journalists in Brighton, aided by volunteer and student journalists all over Britain. It's sustained by a range of funders including MLA, Arts Council England and Visit Britain. Event listings, collection information and venue details are a vital part of the site. This information comes from a live database which UK museums, galleries, libraries and archives are able to use directly. Find out more about being part of our database here.
- http://www.education-world.com/a_curr/curr148.shtml – American website with ideas for activities – business-orientated activities.
- Welcome to Wakefield Museum – an innovative resource on adult literacy and numeracy for teachers and learners inspired by museums' collections. <http://www.mylearning.org/overview.asp?journeyid=450>
- Victoria Baths Manchester – an online quiz for adults linked to an adult learner pack containing literacy and numeracy activities. <http://www.waterpalace.org.uk/?tok=1>

- *Families, learning and culture – Inspiring families through museums, libraries and archives*, MLA/NIACE (2008) <http://www.niace.org.uk/development-research/programmes-of-work/families-learning-and-culture-inspiring-families-through-mus>
- Numeracy-related activities in Hertfordshire museums. www.cultureandschoolseast.org.uk
- Londoners Still Need to Read – Libraries for Learning project (2006-08) http://www.mlalondon.org.uk/uploads/documents/Londoners_Still_Need_to_Read.pdf
- Renaissance South East website. <http://www.museumse.org.uk>
- Royal Game of Ur online at the British Museum's [Mesopotamia](http://www.britishmuseum.org/learning/mesopotamia) website (requires Shockwave).
- 'Learning Maths outside the classroom' project – funded by the Department of Children, Schools and Families (DCSF) – resources for learners and CPD activities for school teachers. <http://www.ncetm.org.uk/Default.aspx?page=13&module=res&mode=100&resid=9268>

There are some excellent hard copy resources:

- *A Teacher's Guide to Maths and the Historic Environment*, Tim Copeland, English Heritage.
- *Maths and History*, A Maths 2000 booklet, Essex Records Office.
- *Maths Year 2000, Ideas for Museums, Galleries and Heritage Sites*.
- *Creative Minds*, MLA Yorkshire, a guide to support the development of mathematics and numeracy in museums, libraries and archives, March 2006.

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