Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

Specification

BTEC Professional qualifications

First teaching August 2015

Issue 2

Edexcel, BTEC and LCCI qualifications

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This specification is Issue 2. We will inform centres of any changes to this issue.
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All information in this specification is correct at time of publication.

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Purpose of this specification

The purpose of a specification as defined by Ofqual is to set out:

- the qualification's objective
- any other qualification that a learner must have completed before taking the qualification
- any prior knowledge, skills or understanding that the learner is required to have before taking the qualification
- units that a learner must have completed before the qualification will be awarded and any optional routes
- any other requirements that a learner must have satisfied before they will be assessed or before the qualification will be awarded
- the knowledge, skills and understanding that will be assessed as part of the qualification (giving a clear indication of their coverage and depth)
- the method of any assessment and any associated requirements relating to it
- the criteria against which the learner's level of attainment will be measured (such as assessment criteria)
- any specimen materials
- any specified levels of attainment.

BTEC Professional qualification titles covered by this specification

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

This qualification has been accredited to the Qualifications and Credit Framework (QCF) and is eligible for public funding as determined by the Department for Education (DfE) under Section 96 of the Learning and Skills Act 2000.

The qualification title listed above features in the funding lists published annually by the DfE and on the regularly updated website www.education.gov.uk. The QCF Qualification Number (QN) should be used by centres when they wish to seek public funding for their learners. Each unit within a qualification will also have a QCF unit code.

The QCF qualification and unit codes will appear on learners' final certification documentation.

The QN for the qualification in this publication is:

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)	601/6923/0

This qualification title will appear on learners' certificates. Learners need to be made aware of this when they are recruited by the centre and registered with Pearson.

Contents

What are BTEC Level 5 Professional qualifications?

BTEC Professional qualifications are qualifications at Level 4 to Level 8 in the Qualifications and Credit Framework (QCF) and are designed to provide professional work-related qualifications in a range of sectors. They give learners the knowledge, understanding and skills that they need to prepare for employment. The qualifications also provide career development opportunities for those already in work. Consequently they offer a course of study for full-time or part-time learners in schools, colleges and training centres.

BTEC Professional qualifications provide much of the underpinning knowledge and understanding for the National Occupational Standards for the sector, where these are appropriate. They are supported by the relevant Standards Setting Body (SSB) or Sector Skills Council (SSC). A number of BTEC Professional qualifications are recognised as the knowledge components of Apprenticeships Frameworks.

On successful completion of a BTEC Professional qualification, learners can progress to or within employment and/or continue their study in the same or related vocational area.

The QCF is a framework which awards credit for qualifications and units and aims to present qualifications in a way that is easy to understand and measure. It enables learners to gain qualifications at their own pace along flexible routes.

There are three sizes of qualification in the QCF:

- Award (1 to 12 credits)
- Certificate (13 to 36 credits)
- Diploma (37 credits and above).

Every unit and qualification in the framework will have a credit value.

The credit value of a unit specifies the number of credits that will be awarded to a learner who has achieved the learning outcomes of the unit.

The credit value of a unit is based on:

- one credit for those learning outcomes achievable in 10 hours of learning
- learning time – defined as the time taken by learners at the level of the unit, on average, to complete the learning outcomes of the unit to the standard determined by the assessment criteria.

The credit value of the unit will remain constant in all contexts, regardless of the assessment method used for the qualification(s) to which it contributes.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

BTEC Level 5 Diploma

The BTEC Level 5 Diploma extends the work-related focus from the BTEC Level 5 Certificate. There is potential for the qualification to prepare learners for employment in a particular vocational sector and it is suitable for those who have decided that they wish to enter a specific area of work.

Key features of the Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

The Pearson BTEC Level 5 Diploma Teaching Mathematics: Numeracy (QCF) is a 'stand-alone' specialist qualification designed for those working or wishing to work as specialist mathematics (numeracy) teachers/trainers, in England.

This qualification covers the knowledge and skills required by specialist numeracy teachers/trainers, such as:

- theories and frameworks
- teaching and learning strategies.

The qualification will give learners an understanding of:

- the factors that influence the development and progression of numeracy learners and how numeracy can impact on different contexts and subjects
- the use of assessment and numeracy teaching approaches and resources to meet the needs of numeracy learners
- how to liaise with others to promote the inclusion of numeracy and wider skills in learning programmes
- the fundamental attributes of mathematics and numeracy and the attributes of procedures in mathematics and numeracy
- how learning theories and the origins and status of mathematics impact on numeracy teaching
- the links between the roles and perceptions of mathematics and numeracy in society.

The qualification also gives learners the opportunity to develop skills to:

- plan and deliver inclusive numeracy teaching and learning
- assess the knowledge, understanding and skills of numeracy learners
- use communication strategies and techniques in numeracy learning
- promote learning support and learner support in numeracy teaching and learning.

National Occupational Standards

Where relevant, BTEC Level 5 qualifications are designed to provide some of the underpinning knowledge and understanding for the National Occupational Standards (NOS), as well as developing practical skills in preparation for work and possible achievement of NVQs in due course. NOS form the basis of National Vocational Qualifications (NVQs). BTEC Level 5 (QCF) qualifications do not purport to deliver occupational competence in the sector, which should be demonstrated in a work context.

Rules of combination

The rules of combination specify the credits that need to be achieved, through the completion of particular units, for the qualification to be awarded. All accredited qualifications within the QCF have rules of combination.

Rules of combination for Pearson BTEC Level 5 qualifications

When combining units for a Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF), it is the centre's responsibility to ensure that the following rules of combination are adhered to.

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

1 Qualification credit value: minimum of 45 credits.

2 Minimum credit to be achieved at, or above, the level of the qualification: 45 credits.

3 All credits must be achieved from the units listed in this specification.

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

The Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF) is a 45-credit and 120-guided-learning-hour (GLH) qualification that consists of three mandatory units that offer a combined total of 45 credits.

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)			
Unit	**Mandatory units**	**Credit**	**GLH**
1	Numeracy Teaching and Learning	15	40
2	Numeracy and the Learners	15	40
3	Numeracy Knowledge and Understanding	15	40

Assessment

All units in this qualification are internally assessed. The qualifications are criterion referenced, based on the achievement of all the specified learning outcomes.

To achieve a 'pass' a learner must have successfully passed **all** the assessment criteria.

Guidance

The purpose of assessment is to ensure that effective learning has taken place to give learners the opportunity to:

- meet the standard determined by the assessment criteria and
- achieve the learning outcomes.

All the assignments created by centres should be reliable and fit for purpose, and should be built on the unit assessment criteria. Assessment tasks and activities should enable learners to produce valid, sufficient and reliable evidence that relates directly to the specified criteria. Centres should enable learners to produce evidence in a variety of different forms, including performance observation, presentations and posters, along with projects, or time-constrained assessments.

Centres are encouraged to emphasise the practical application of the assessment criteria, providing a realistic scenario for learners to adopt, and making maximum use of practical activities. The creation of assignments that are fit for purpose is vital to achievement and their importance cannot be over-emphasised.

The assessment criteria must be clearly indicated in the assignments briefs. This gives learners focus and helps with internal verification and standardisation processes. It will also help to ensure that learner feedback is specific to the assessment criteria.

When designing assignments briefs, centres are encouraged to identify common topics and themes. A central feature of vocational assessment is that it allows for assessment to be:

- current, i.e. to reflect the most recent developments and issues
- local, i.e. to reflect the employment context of the delivering centre
- flexible to reflect learner needs, i.e. at a time and in a way that matches the learner's requirements so that they can demonstrate achievement.

Qualification grade

Learners who achieve the minimum eligible credit value specified by the rule of combination will achieve the qualification at pass grade.

In BTEC Level 5 Professional qualifications, each unit has a credit value that specifies the number of credits that will be awarded to a learner who has achieved the learning outcomes of the unit. This has been based on:

- one credit for those learning outcomes achievable in 10 hours of learning time
- learning time being defined as the time taken by learners at the level of the unit, on average, to complete the learning outcomes of the unit to the standard determined by the assessment criteria
- the credit value of the unit remaining constant regardless of the method of assessment used or the qualification to which it contributes.

Quality assurance of centres

BTEC Level 4–7 qualifications provide a flexible structure for learners, enabling programmes of varying credits and combining different levels. For the purposes of quality assurance, all individual qualifications and units are considered as a whole.

Centres delivering BTEC Level 4–7 qualifications must be committed to ensuring the quality of the units and qualifications they deliver, through effective standardisation of assessors and verification of assessor decisions. Centre quality assurance and assessment is monitored and guaranteed by Pearson.

Pearson quality assurance processes will involve:

- centre approval for those centres not already recognised as a centre for BTEC qualifications
- approval for BTEC Level 4–7 qualifications and units.

For all centres delivering BTEC qualifications at Levels 4–7, Pearson allocates a Standards Verifier (SV) for each sector offered who will conduct an annual visit to quality assure the programmes.

Approval

Centres are required to declare their commitment to ensuring the quality of the programme of learning and providing appropriate assessment opportunities for learners that lead to valid and accurate assessment outcomes. In addition, centres will commit to undertaking defined training and online standardisation activities.

Centres already holding approval are able to gain qualification approval online. New centres must complete a centre approval application.

Quality assurance guidance

Details of quality assurance for BTEC Level 4–7 qualifications are available on our website.

Programme design and delivery

Mode of delivery

Pearson does not normally define the mode of delivery for BTEC Level 4 to Level 8 qualifications. Centres are free to offer the qualifications using any mode of delivery (such as full-time, part-time, evening only, distance learning) that meets their learners' needs. Whichever mode of delivery is used, centres must ensure that learners have appropriate access to the resources identified in the specification and to the subject specialists delivering the units. This is particularly important for learners studying for the qualification through open or distance learning.

Learners studying for the qualification on a part-time basis bring with them a wealth of experience that should be utilised to maximum effect by tutors and assessors. The use of assessment evidence drawn from learners' work environments should be encouraged. Those planning the programme should aim to enhance the vocational nature of the qualification by:

- liaising with employers to ensure a course relevant to learners' specific needs
- accessing and using non-confidential data and documents from learners' workplaces
- including sponsoring employers in the delivery of the programme and, where appropriate, in the assessment
- linking with company-based/workplace training programmes
- making full use of the variety of experience of work and life that learners bring to the programme.

Where legislation is taught, centres must ensure that it is current and up to date.

Resources

BTEC Level 5 qualifications are designed to give learners an understanding of the skills needed for specific vocational sectors. Physical resources need to support the delivery of the programme and the assessment of the learning outcomes, and should therefore normally be of industry standard. Staff delivering programmes and conducting the assessments should be familiar with current practice and standards in the sector concerned. Centres will need to meet any specific resource requirements to gain approval from Pearson.

Where specific resources are required, these have been indicated in individual units in the *Essential resources* sections.

Delivery approach

It is important that centres develop an approach to teaching and learning that supports the vocational nature of BTEC Level 5 qualifications and the mode of delivery. Specifications give a balance of practical skill development and knowledge requirements, some of which can be theoretical in nature. Tutors and assessors need to ensure that appropriate links are made between theory and practical application and that the knowledge base is applied to the sector. This requires the development of relevant and up-to-date teaching materials that allow learners to apply their learning to actual events and activity in the sector. Maximum use should be made of learners' experience.

Access and recruitment

Pearson's policy regarding access to its qualifications is that:

- they should be available to everyone who is capable of reaching the required standards
- they should be free from any barriers that restrict access and progression
- there should be equal opportunities for all wishing to access the qualifications.

Centres are required to recruit learners to BTEC qualifications with integrity. This includes ensuring that applicants have appropriate information and advice about the qualifications and that the chosen qualification will meet their needs. Centres should take appropriate steps to assess each applicant's potential and make a professional judgement about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner in the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification. Centres should consult our policy on learners with particular requirements.

Centres will need to review the entry profile of qualifications and/or experience held by applicants, considering whether this profile shows an ability to progress to a higher level qualification.

Access to qualifications for learners with disabilities or specific needs

Equality and fairness are central to our work. Pearson's Equality Policy requires all learners to have equal opportunity to access our qualifications and assessments. It also requires our qualifications to be awarded in a way that is fair to every learner.

We are committed to making sure that:

- learners with a protected characteristic (as defined by the Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to learners who do not share that characteristic
- all learners achieve the recognition they deserve from undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Learners taking a qualification may be assessed in British sign language or Irish sign language where it is permitted for the purpose of reasonable adjustments.

Further information on access arrangements can be found in the Joint Council for Qualifications (JCQ) document *Access Arrangements and Reasonable Adjustments: General and Vocational qualifications*.

Details on how to make adjustments for learners with protected characteristics are given in the Pearson document *Supplementary guidance for reasonable adjustments and special consideration in vocational internally assessed units*.

Both documents are on our website.

Restrictions on learner entry

The Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF) is accredited on the QCF for learners aged 19 and above.

Learners must be qualified/experienced in this specialist subject, i.e. mathematics (numeracy). Learners can be based in FE colleges, adult and community learning centres, or be training providers or delivering work-based training in voluntary, public and private organisations.

The qualification is suitable for:

- learners who want to be specialist teachers but who are not in a teaching/training role or have just started a teaching/training role
- qualified teachers/trainers who wish to become qualified specialist teachers
- teachers/trainers who are seeking career progression in their area of work
- learners who are assessors and wish to achieve a specialist qualification
- learners who have completed generic Level 3 and Level 4 qualifications in education and training and wish to progress to teaching in a specialist area.

Recognising prior learning and achievement

Recognition of Prior Learning

Recognition of Prior Learning (RPL) is a method of assessment (leading to the award of credit) that considers whether a learner can demonstrate that they can meet the assessment requirements for a unit through knowledge, understanding or skills they already possess and so do not need to develop through a course of learning.

Pearson encourages centres to recognise learners' previous achievements and experiences whether at work, home and at leisure, as well as in the classroom. RPL provides a route for the recognition of the achievements resulting from continuous learning.

RPL enables recognition of achievement from a range of activities using any valid assessment methodology. Provided that the assessment requirements of a given unit or qualification have been met, the use of RPL is acceptable for accrediting a unit, units or a whole qualification. Evidence of learning must be sufficient, reliable and valid.

There is further guidance in our policy document *Recognition of prior learning policy and process,* available on our website.

Credit transfer

Credit transfer describes the process of using a credit or credits awarded in the context of a different qualification or awarded by a different awarding organisation towards the achievement requirements of another qualification. All awarding organisations recognise the credits awarded by all other awarding organisations that operate within the QCF.

If learners achieve credits with other awarding organisations, they do not need to retake any assessment for the same units. The centre must keep evidence of credit achievement.

Unit format

All units in BTEC Level 5 Professional qualifications have a standard format. The unit format is designed to give guidance on the requirements of the qualification for learners, tutors, assessors and those responsible for monitoring national standards.

Each unit has the following sections.

Unit title

The unit title is on the QCF and this form of words will appear on the learner's Notification of Performance (NOP).

Unit reference number

Each unit is assigned a unit reference number that appears with the unit title on the Register of Regulated Qualifications.

QCF level

All units and qualifications within the QCF have a level assigned to them. There are nine levels of achievement, from Entry to Level 8. The QCF Level Descriptors and, where appropriate, the NOS and/or other sector/professional benchmarks, inform the allocation of level.

Credit value

All units have a credit value. The minimum credit value that may be determined for a unit is one, and credits can only be awarded in whole numbers. Learners will be awarded credits for the successful completion of whole units.

Guided learning hours

Guided learning hours are defined as all the times when a tutor, trainer or facilitator is present to give specific guidance towards the learning aim being studied on a programme. This definition includes lectures, tutorials and supervised study in, for example, open learning centres and learning workshops. It also includes time spent by staff assessing learners' achievements. It does not include the time spent by staff marking assignments or homework where the learner is not present.

Unit introduction

The unit introduction gives the reader an appreciation of the unit in the vocational setting of the qualification, as well as highlighting the focus of the unit. It gives the reader a snapshot of the unit and the key knowledge, skills and understanding gained while studying the unit. The unit introduction also highlights any links to the appropriate vocational sector by describing how the unit relates to that sector.

Learning outcomes

The learning outcomes of a unit set out what a learner knows, understands or is able to do as the result of a process of learning.

Assessment criteria

Assessment criteria specify the standard required by the learner to achieve each learning outcome.

Unit content

The unit content identifies the breadth of knowledge, skills and understanding needed to design and deliver a programme of learning to achieve each of the learning outcomes. This is informed by the underpinning knowledge and understanding requirements of the related National Occupational Standards (NOS), where relevant. The content provides the range of subject material for the programme of learning and specifies the skills, knowledge and understanding required for achievement of the unit.

Each learning outcome is stated in full and the key phrases or concepts related to that learning outcome are listed in italics followed by the subsequent range of related topics.

Relationship between content and assessment criteria

The learner should have the opportunity to cover all of the unit content.

It is not a requirement of the unit specification that all of the content is assessed. However, the indicative content will need to be covered in a programme of learning in order for learners to be able to meet the standard determined in the assessment criteria.

Legislation

Legislation cited in the units is current at time of publication. The most recent legislation should be taught and assessed internally.

Content structure and terminology

The information below shows how the unit content is structured and gives the terminology used to explain the different components in the content.

- Learning outcome: this is shown in bold at the beginning of each section of content.
- Italicised sub-heading: it contains a key phrase or concept. This is content that should be covered in the delivery of the unit. Colons mark the end of an italicised sub-heading.
- Elements of content: the elements are in plain text and amplify the sub-heading. The elements should be covered in the delivery of the unit. Semi-colons mark the end of an element.
- Brackets contain amplification of content that must be covered in the delivery of the unit.
- 'e.g.' is a list of examples, used for indicative amplification of an element (that is, the content specified in this amplification could be covered or could be replaced by other, similar material).

Essential guidance for tutors

This section gives tutors additional guidance and amplification to aid understanding and a consistent level of delivery and assessment. It is divided into the following sections.

- *Delivery* – explains the content's relationship to the learning outcomes and offers guidance about possible approaches to delivery. This section is based on the more usual delivery modes but is not intended to rule out alternative approaches.
- *Assessment* – gives amplification about the nature and type of evidence that learners need to produce in order to achieve the unit. This section should be read in conjunction with the assessment criteria.
- *Essential resources* – identifies any specialist resources needed to allow learners to generate the evidence required for each unit. The centre will be asked to ensure that any requirements are in place when it seeks approval from Pearson to offer the qualification.
- *Indicative resource materials* – gives a list of resource material that benchmarks the level of study.

Units

Units

Unit 1: Numeracy Teaching and Learning

Unit reference number: M/505/0766
QCF Level: 5
Credit value: 15
Guided learning hours: 45

Unit introduction

In this unit you will learn about the process of lesson planning from theory through to practice. It includes a focus on diagnostic assessment as a way to inform planning as well as the use of formative assessment throughout the teaching cycle. The unit considers ways to maintain a positive learning environment in which individual needs are met and individuals feel safe and secure.

In this unit you will develop skills that allow you to address a range of needs during lesson planning. You will learn to consider mathematical content, diagnostic assessments, teaching approaches, resources, classroom environment and the needs of the individual as well as the professional standards against which teachers are assessed. You will explore the use of a range of diagnostic assessment methods and develop their use to support the planning process and target setting. You will learn how to use and maintain assessment records in order to support planning and teaching. In addition, this unit will enable you to develop your repertoire of activities, resources and teaching styles to provide a learning environment that is inclusive and nurturing and that allows numeracy learners to develop both their mathematical skills and their ability to accurately and concisely communicate their ideas. As a learner you will also have the opportunity to critically analyse your own teaching practice using a range of techniques in order to develop your skills and knowledge.

Learning outcomes and assessment criteria

To pass this unit, the evidence that learners present for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

On completion of this unit a learner should:

Learning outcomes	Assessment criteria
1 Be able to plan inclusive numeracy teaching and learning	1.1 Plan numeracy teaching and learning to meet the needs of numeracy learners and curriculum requirements using: • own specialist numeracy knowledge • the results of numeracy initial and diagnostic assessment 1.2 Select numeracy teaching approaches and resources to meet the individual needs of numeracy learners
2 Be able to assess learners' numeracy knowledge, understanding and skills	2.1 Carry out initial and diagnostic assessment to identify learners' existing mathematical and numeracy skills, knowledge, understanding and aspirations 2.2 Involve learners in the processes of assessment and target setting 2.3 Use numeracy assessment tools to measure the development of learners' numeracy skills 2.4 Record numeracy assessment information in accordance with organisational systems
3 Be able to deliver inclusive numeracy teaching and learning	3.1 Maintain a supportive and challenging numeracy learning environment that motivates learners and meets their needs 3.2 Use numeracy teaching approaches and resources to develop the numeracy skills of individual learners

Learning outcomes	Assessment criteria
4 Be able to use communication strategies and techniques in numeracy learning	4.1 Devise communication strategies to enable learners to develop numeracy language and vocabulary 4.2 Use communication strategies to enable learners to develop numeracy language and vocabulary 4.3 Use collaborative learning techniques to improve numeracy learning and problem solving 4.4 Use communication strategies to develop the literacy and language skills needed by learners to develop their numeracy and problem-solving skills
5 Be able to evaluate own practice in numeracy teaching	5.1 Reflect on own practice in numeracy teaching, drawing on: • own research in numeracy teaching and learning • learners' assessment data • feedback from learners • feedback from colleagues 5.2 Identify ways to improve own practice in numeracy teaching

Unit content

1 **Be able to plan inclusive numeracy teaching and learning**

Knowledge and strategies for effective planning: planning tools, e.g. medium-term plans, learning objectives, *Framework for Teaching Mathematics: Yr 7, 8 and 9* (DfE), textbooks; research documents, such as *Key Understandings in Mathematical Learning* (Nuffield Foundation); components that inform the planning process, such as knowing the features of effective mathematics teaching, e.g. using clear objectives, incorporating regular oral and mental work, building on prior knowledge, planning for progression, (including stretch and challenge), effectively using lesson time, managing behaviour for learning; knowing progression within a topic and current abilities of numeracy learners in order to plan appropriate but challenging activities that encourage positive attitudes towards learning; professional standards against which teachers are assessed, e.g. promoting love of learning, setting homework, differentiation based on ability, special educational needs or English as a second language, use of teaching and assessment approaches

Effective planning of mathematical content: understanding of the mathematical content to be taught, e.g. progression, misconceptions and common errors, specialist language, connections to other areas of mathematics, range of mathematical strategies available; stages of progression from additive to multiplicative thinking; links to array, area and commutativity; knowledge of the range of strategies available for multiplication; using diagnostic results to plan tailored lessons, e.g. knowledge of numeracy learners' current attainment, gaps in prior knowledge, misconceptions, incorrect use of algorithms, computational errors

Effective planning of teaching activities: selecting activities for different parts of the lesson, e.g. starter, main, plenary; activities that are relevant to the numeracy content and numeracy learner as an individual, and delivered appropriately, e.g. use of scientific calculators to support work on the order of operations, allowing numeracy learners to question in what order the calculator is performing the operations and comparing this to their own ideas and beliefs; consideration of the personal, social, economic and language barriers present in individual numeracy learners, e.g. using Bowland Maths resources such as *Product Wars* to make links to popular culture, allowing numeracy learners to display elements of their social and cultural background through the creative elements of the project; building on what numeracy learners already know; development of new knowledge firmly linked to prior knowledge; use of contexts relevant to the learners, such as linking to vocational content, hobbies or interests

2 **Be able to assess learners' numeracy knowledge, understanding and skills**

Theory and research on assessment: current research into initial, formative and summative assessment techniques, such as Ketterlin-Geller, Yovanoff, Pellegrino, Chudowsky and Glaser, Black and Wiliam; consider a range of approaches, e.g. response, skills and error analyses, cognitive diagnostic, sharing learning objectives, questioning, peer and self-assessment, providing feedback that moves learners forward

Diagnostic assessment methods: purpose of initial assessment, e.g. diagnosing strengths, highlighting gaps in learning, displaying misconceptions, improving planning and outcomes, setting targets; using a range of diagnostic assessment activities, e.g. tests, tasks, interviews, work scrutiny, online assessment packages such as bksb®; using results from diagnostic assessment for a range of activities, e.g. identifying misconceptions, planning targeted activities, designing effective lessons, recording current attainment, setting targets

Formative and summative assessment methods: methods for measuring progress made by individual numeracy learners – oral or written communication, tests, assessment activities and peer and self-assessments that allow numeracy learners to be an integral part of the process, e.g. use of progression maps in a learner-led activity to identify individual learners' current knowledge and next steps in a specified area of numeracy

Maintaining records of numeracy learners' knowledge and skills: documentation of assessments, discussions, written work and misconceptions, which build up a profile of numeracy learners' current learning needs, e.g. use of traffic light system for recording understanding against assessment criteria, informal notes on individuals and their specific learning issues, summative test scores, assessed levels and grades; paper- or computer-based documentation; documentation for organisations conforming to the policies and practices of the given organisation, e.g. using SIMS Assessment and Reporting Suite in a school environment

3 **Be able to deliver inclusive numeracy teaching and learning**

Maintaining the motivation of the numeracy learner through the use of varying classroom practices: technology, e.g. projectors, smartboard, computers, clickers, mobile phones, calculators, stopwatch, camera, visualizer, dynamic software, Excel®, YouTube™, social media, games; dynamic software packages to plot graphs and investigate properties and patterns; practical resources, such as tape measures, newton spring balance, multi-link, Numicon, Cuisenaire® Rods, plastic money, 2D and 3D shapes, peg boards; use of a range of activity styles, e.g. individual study, discussion, group work, constructivist, direct instruction, inquiry-based investigations, paired work

Delivering inclusive numeracy teaching and learning: approaches that take into account the range of numeracy learners' backgrounds, histories, learning goals and preferences and cognitive styles; strategies to differentiate teaching and learning according to numeracy learners' different skills and previous experiences of numeracy

Inclusive approaches and addressing barriers: using resources including assessments, progression maps and school information held about the individual, such as access to free school meals, in order to understand specific needs and possible barriers to learning; the importance of knowing learners and their needs and personalities; ensuring each individual is spoken to and monitored in every lesson; adapting resources as necessary for content and accessibility according to individual learners' needs, interests and abilities, e.g. using one-directional protractors with individuals who have difficulty coping with the double scale, providing a writing frame for learners who need additional support with developing language; ensuring no learner is isolated and that a culture of respect prevails in all lessons; ensuring that good practice is modelled in working with learners with a range of difficulties and disabilities

4 **Be able to use communication strategies and techniques in numeracy learning**

Developing the vocabulary of mathematics: supporting learning and retention of mathematics vocabulary through multiple exposure to a range of activities, e.g. linguistic methods such as reading, writing, talking and listening, highlighting vocabulary through breaking words down into their sub-meanings and definitions, use of key word lists, mathematical dictionary, classifying, comparing and analogies or non-linguistic methods such as pictorial representations, use of manipulatives, kinaesthetic activities

Developing the language of mathematics: support development of numeracy learners' ability to understand and express mathematical ideas through a range of activities, e.g. analysing text, defining different parts of the language (noun, adjective, verb), comprehension, questioning, encouraging and correcting verbal input, separating the mathematical and contextual content of a problem

Developing symbolic and pictorial representations of mathematical language: strategies to develop fluency in using mathematical notation as well as symbolic and pictorial representations, alongside verbal and written communication, e.g. analysing pictorial representations, drawing diagrams based on verbal information, listing what can or cannot be deduced from a given diagram, turning symbolic representations into diagrams and vice versa, comparing symbolic and pictorial representations to written text; using dynamic software packages such as GeoGebra to construct mathematical objects defined in written text

Group work as a strategy to improve understanding and reasoning skills: managed group work with established group goals, effective group size, a range of skill bases contained in group, trust, open communication and individual roles; modelling of successful group interactions emphasising mathematical vocabulary and effective communication, including written and verbal communication between teachers, groups and individuals

5 **Be able to evaluate own practice in numeracy teaching**

Implementing reflective practice: theory and ideas of an enquiry-based practice, e.g. Dewey, Schön, Zeichner and Liston; developing appropriate self-critical skills; receiving and acting on developmental feedback from numeracy learners, colleagues and other professionals; engaging in continuous professional learning and development; using techniques such as planning, delivery, evaluation, analysis, conclusion and next steps; using a range of methods, such as video, peer observations, feedback from numeracy learners, work scrutiny or a reflective diary; areas for analysis, including the mathematical content – examples used, misconceptions highlighted, use of mathematical vocabulary; teaching activities and classroom management, e.g. guided learning, group work, use of ICT, timings, managing resources

Setting personal developmental priorities and targets: identifying ways in which practice can be further developed; considering feedback from learners, colleagues and observed teaching practice to set personal development targets and evaluate progress against these; recording progress and key learning points; reflecting on own progress at different stages of the course and teaching practice

Essential guidance for tutors

Delivery

In this unit learners have the opportunity to develop their classroom practice. Learners will aim to develop their skills in planning supportive, challenging and motivating lessons. Tutors could give learners the opportunity to develop their knowledge of effective planning with, for example, the use of the National Strategies document *Inclusive teaching in Mathematics* (DfE 2008). Planning may focus on mathematical development in general and the needs of individuals in particular, as well as teaching and assessment approaches.

Tutors could cover a comprehensive range of teaching methods, including guided learning, group work, mastery techniques, demonstration, investigation, discussion, etc. Consideration could extend to the types of resources that may be best suited to any given method. For example, discussion could focus on when it would be most appropriate to use worksheets, open-ended problems, computers or practical equipment and how these resources could be best used for different teaching approaches. Learners may then wish to explore how use of these methods and resources impact on the learning environment. Learners could trial various activities with their numeracy learners and, through learner feedback, consider to what extent distinct approaches impact on challenge, interest, confidence and the personal aspirations of the individual.

When reviewing assessment techniques, tutors may wish to refer to research, such as *The Black Box Project* (Black and Wiliam, 1998) or the Department for Education resource *National Strategies: Secondary Mathematics – Assessment for Learning* (DfE, 2000–2009). Analysis could focus on diagnostic, formative and summative assessment methods and how to integrate them in the teaching cycle. For example, learners may wish to consider the importance of building on their numeracy learners' current skills set when planning lessons, and as such may wish to select, design and implement diagnostic assessments relevant to upcoming teaching topics and the group of numeracy learners. Learners could work together to analyse the results of these assessments in relation to the content to be taught. Discussions could include the effectiveness of different types of assessment tasks (tests, interviews, work scrutiny, progression maps) in pinpointing numeracy learners' skills, knowledge and learning needs and providing useful information for future planning. The results of these diagnostic tests could form the basis for future planning.

Language skills are necessary for all forms of effective communication and mathematics has its own set of specialist language that enables mathematicians to communicate clearly and precisely. Tutors could provide opportunities for learners to explore the specialist vocabulary contained in certain areas of mathematics. For example, learners could highlight key words for dealing with ratio and proportion and discuss how a poor understanding of the meaning of these words may impact on their numeracy learners in the classroom. Learners may then wish to consider strategies for promoting language development by referring to research, such as the report *Building Mathematics Vocabulary* (Dr M Kovarik, 2010). Learners could then design and trial activities based on a range of ideas, such as hangman, key word lists, use of physical movement or visualisation techniques.

Extension of fluent language skills may also be explored through the use of group work that promotes and encourages communication between the members of the team. Tutors could support learners in developing their understanding teaching approach by selective use of activities from the Group Work section contained in

the Department for Education curriculum and standards unit *Pedagogy and Practice: Teaching and Learning in Secondary Schools* (DfE, 2004). Learners may wish to use the inclusion of group work as an ideal opportunity to support numeracy learners in their development of problem-solving skills. In particular, they may consider the specific vocabulary used when working mathematically (interpret, select, formulate, represent, justify) in order to improve the communication between the group, individual and teacher.

Building a reflective practice is integral to developing any teacher's practice. Tutors may wish to begin by having learners reflect on what it means to be a reflective teacher. Learners could discuss the ideas of Dewey, Schön or Zeichner and Liston, among others, and compare these ideas with their own beliefs. Learners could then begin to analyse their own practice using resources, such as Gibbs' Reflective Cycle (1988) or *Pedagogy and Practice: Teaching and Learning in Secondary Schools* (DfE, 2004). Learners may wish to work in pairs or groups and use techniques such as video, peer observations, feedback from numeracy learners and work scrutiny to identify the strengths and weaknesses in their practice. This may lead to the learners altering areas of their practice and trialling new ideas in the classroom.

Assessment

This section should be read in conjunction with the *Assessment* section at the front of the document.

To pass this unit, the evidence that learners present for assessment must demonstrate that they have met the required standard specified in the learning outcomes and assessment criteria, and the requirements of the document in *Annexe A – Summary of practice, including observed and assessed practice, requirements*.

To complete the qualification, learners need to complete a minimum of 50 hours of teaching practice in a numeracy teaching and learning environment.

In this unit learners demonstrate that they can teach, reflect on their practice and that they are developing in line with the overarching professional standards. The minimum number of practice hours for this unit is not specified. However, it is not possible to achieve this unit without completing some hours of practice.

To be eligible for the award of credit for this unit, the trainee teacher must be able to give evidence of a minimum of four assessed observations totalling a minimum of four hours that meet the required standard of practice. Any single observation session must be of a minimum of 30 minutes. All four of these observations must be in a numeracy context. There is a requirement to evidence working with groups of learners to achieve this qualification. Assessed observations should include at least one numeracy observation at Entry Level. Simulation is not permitted.

To give evidence for all the learning outcomes, learners could produce a portfolio of their teaching. For all the following learning outcomes, learners should be integrating theory with observed practice, which they reflect on.

Learning outcomes 1, 2 and 3 could be assessed through a plan/teach cycle where learners demonstrate their abilities in planning, assessing and classroom management. Learners could use their knowledge of the numerical content of the area to be taught to design, deliver and analyse a diagnostic assessment before the planning stage. Learners' selection of teaching approaches and choice of resources could take into account the results of the assessment, needs of numeracy learners and knowledge of the mathematical content. Consideration may be given to opportunities to carry out formative assessment during the learning cycle. This process could be written up as a report of no more than 2500 words and submitted with a copy of the teaching plan, resources and assessment records.

In delivering their planned teaching, learners could demonstrate their classroom management, delivery of planned activities and use of formative assessment. Formal observation of learners' classroom practice will form part of the evidence base for these learning outcomes, along with a written report of no more than 2000 words, in which learners critically analyse the effectiveness of their planning, resources and delivery in relation to numeracy development and the classroom environment. Analysis of progress may refer to assessment records and a copy of these records may be submitted with the report if relevant.

Learners should be assessed on the quality of their planning, which should evidence the depth of their specialist mathematical knowledge, an understanding of the purpose for selecting or developing specific resources in order to develop numerical understanding and effective use of diagnostic assessment. In the report, learners should demonstrate their understanding of the mathematics in terms of progression, connections and misconceptions. They should show how they used the diagnostic test to inform the planning and agree targets with numeracy learners as well as include an analysis in relation to the mathematical content and their choice of teaching approaches and resources.

Learners should be assessed on the challenge, support and motivation evident in the classroom environment as well as the effectiveness of the resources used in fulfilling the needs of numeracy learners. Learners will have demonstrated the use of formative assessment during the teaching cycle. In the report, learners should include an analysis of their initial plan in relation to the learning outcomes of numeracy learners. Consideration should be given to how their choice of activities and mathematical content impacts on the learning environment and the mathematical progress made by the individual numeracy learners. Any analysis of progress made should be referenced against the assessment records of diagnostic, formative and summative assessments.

Learning outcomes 5 and 6 could be assessed through an action research project of up to 5000 words into the effects of a reflective practice in enhancing teaching skills and knowledge. The focus of the project could be the development of communication skills for problem solving and subject-specific vocabulary. The project could be broken down into the following components. Learners could begin by reviewing the current evidence related to mathematical language development, as well as analysing the key vocabulary and language skills that may impact on numeracy development in a given area. This information could be written as a report of no more than 1500 words. Based on this report, learners could design a plan-teach-review cycle that includes assessment, designed teaching resources, details of teaching approaches and proposed means of evaluations. As part of the project, learners could submit an abstract of their proposal of no more than 1000 words. At the completion of the plan-teach cycle, learners could review the evidence, such as video, interviews, peer assessment and written work in order to identify ways to improve their teaching in this area. This section could be assessed through a combination of lesson observations and a written report of no more than 2500 words.

Learners should be assessed on the quality, design and use of resources specific to developing language and vocabulary, as well as their management of collaborative problem-solving strategies in the classroom. Learners should be assessed on their ability to use independent research as well as critically analyse their planning and teaching in order to develop their own practice. Learners should demonstrate their ability to use a range of evidence during the self-evaluation stage, including feedback from learners and colleagues and analysis of assessment data and written work.

Essential resources

There are no essential resources required for this unit.

Indicative resource materials

Books

Black P and Wiliam D – *Inside the Black Box: Raising Standards Through Classroom Assessment* (GL Assessment, 2005) ISBN 9780708713815

Boaler J – *The Elephant in the Classroom: Helping Children Learn and Love Maths* (Souvenir Press Ltd, 2009) ISBN 9780285638471

Chambers P and Timlin R – *Teaching Mathematics in the Secondary School* (Sage, 2013) ISBN 9781446259016

Johnston-Wilder S et al – *Learning to Teach Mathematics in the Secondary School: A Companion to School Experience* (Routledge, 2011) ISBN 9780415565585

Pellegrino J, Chudowsky N, and Glaser R – *Knowing what Students Know: The Science and Design of Educational Assessment* (National Academy Press, 2001) ISBN 9780309072724

Swan M – *Collaborative Learning in Mathematics: A Challenge to Our Beliefs and Practices* (NIACE, 2006) ISBN 9781862013117

Tanner H and Jones S – *Becoming a Successful Teacher of Mathematics* (Routledge, 2000) ISBN 9780415230698

Websites

www.bksb.co.uk	Online diagnostic assessment package
www.bowlandmaths.org.uk	Maths resources that promote collaborative work, mathematical reasoning and problem solving
www.ncetm.org.uk	National Centre for the Excellence of Teaching Mathematics
www.nuffieldfoundation.org	Nuffield Foundation website
www.open.ac.uk	The Open University's website
www.stem.org.uk	STEM website. Contains much of the original National Strategy Resources

Other resources

Chanda N et al – *Maths4Life: Integrating Formative and Diagnostic Assessment Techniques into Teachers' Routine Practice in Adult Numeracy* (NRDC, 2007)

Department for Education – *National Strategies: Secondary Mathematics – Assessment for Learning* (DfE, 2000–2009)

Department for Education Standards Unit – *Pedagogy and Practice: Teaching and Learning in Secondary Schools* (DfE, 2004)

Department for Education Standards Unit – *Improving Learning in Mathematics* professional development materials (DfE, 2000–2009)

Finlay L – *Reflecting on reflective practice* (The Open University, 2008)

Ketterlin-Geller L and Yovanoff P – *Diagnostic Assessments in Mathematics to Support Instructional Decision Making* (Practical Assessment, Research and Evaluation, Vol 14, October 2009)

Kovarik M – *Building Mathematics Vocabulary* (International Journal for Mathematics Teaching and Learning, 2010)

Unit 2: Numeracy and the Learners

Unit reference number: K/505/0765
QCF Level: 5
Credit value: 15
Guided learning hours: 40

Unit introduction

In this unit you will learn about the ways that pedagogical approaches impact on numeracy learners and their ability to make progress. The unit also addresses barriers to learning, such as an individual's personal background. This unit includes an analysis of the numeracy curriculum and the progression though the levels of attainment, along with an analysis of various assessment approaches and how they can be used to inform planning, support progression, or make summative judgements. In addition, this unit highlights the extended network of professionals that is available to support numeracy learners and considers how to develop professional relationships with colleagues in order to support the overall development of numeracy learners.

In this unit you will explore possible barriers to learning, such as the socio-economic background of numeracy learners or their difficulties in making sense of how mathematics is presented. You will develop your teaching practice to incorporate strategies for supporting numeracy learners to overcome such barriers and you will have the opportunity to explore different teaching approaches, including the use of technology, and analyse how they impact on numeracy learners. You will explore the use of assessment in a range of contexts and how it can be embedded in your practice to support numeracy learners in making progress. You will improve your knowledge of the content of the numeracy curriculum and how it maps from one stage to the next. In addition, you will have the opportunity to consider how the development of numeracy skills may have a positive impact on numeracy learners' personal development or goals. You will learn to distinguish between the range of additional learning support that is available and develop the necessary skills to select, aid and monitor any additional support that numeracy learners may receive. You will learn how to form effective relationships with colleagues and develop an understanding of other curriculums, including where numeracy can be developed within them. You will learn how to manage joint projects in order to develop the wider skills of numeracy learners in their numeracy lessons and support the inclusion of numeracy across the curriculum.

Learning outcomes and assessment criteria

To pass this unit, the evidence that learners present for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

On completion of this unit a learner should:

Learning outcomes	Assessment criteria
1 Understand the factors that influence the development and progression of numeracy learners	1.1 Analyse the impact of personal, social, economic and political factors on the development and progression of numeracy learners 1.2 Explain the impact of learners' literacy and language skills on the development and progression of their numeracy skills 1.3 Explain how differing communication approaches can affect the learning of numeracy processes and skills
2 Understand the use of assessment approaches to meet the needs of numeracy learners	2.1 Identify the skills, knowledge and understanding that can be assessed in numeracy 2.2 Analyse approaches to initial and diagnostic assessment to identify the mathematics and numeracy skills and aspirations of numeracy learners 2.3 Analyse the use of assessment tools in numeracy teaching and learning
3 Understand the use of numeracy teaching approaches and resources to meet the needs of individual numeracy learners	3.1 Analyse numeracy teaching approaches and resources, including technologies, for suitability in meeting individual learners' needs 3.2 Analyse the impact of using technology on learner engagement, motivation and success in numeracy teaching and learning

Learning outcomes	Assessment criteria
4 Understand how numeracy can impact on different contexts and subjects	4.1 Identify the numeracy skills and knowledge needed by learners across contexts and subjects, and for progression purposes 4.2 Explain the importance of encouraging learners to make links between their mathematical and numeracy development and their other personal development
5 Be able to promote learning support and learner support in numeracy teaching and learning	5.1 Explain the boundaries between own specialist area and those of other specialists and practitioners 5.2 Analyse numeracy learning opportunities to determine how teaching and support needs may be shared between learning professionals
6 Understand how to liaise with others to promote the inclusion of numeracy and wider skills in learning programmes	6.1 Explain how to liaise with other professionals to provide specialist knowledge of how to include numeracy in vocational and other subject areas 6.2 Explain how to liaise with other professionals to promote the inclusion of wider skills in own specialist area

Unit content

1 **Understand the factors that influence the development and progression of numeracy learners**

Impact of external factors on numeracy development: research evidence, e.g. Nunes, Ginsburg and Russell, Green, Dugoni, Ingels and Cambum; impact of an individual's background on their numeracy development, e.g. socio-economic status, parents' education, cultural capital, gender and ethnicity; effect of social and political policies on an individual learner's numeracy development, e.g. curriculum content and streaming

The language of mathematics: relevant research into the use of language in the mathematics classroom, e.g. Pimm, Schleppegrell, Zevenbergen, Adams; the way language constructs mathematical knowledge, e.g. grammatical patterning, use of qualifiers, identifying processes, use of conjunctions and constructions

Communicating mathematically: diverse forms of communication used in the mathematics classroom, e.g. the spoken and written language and its relationship to visual representation and symbolic language; teaching practices that develop the understanding of numeracy through focusing on the linguistic elements, e.g. comparing mathematical words with their everyday meaning (odd:strange, volume:sound level, angle:point of view), the use of peer discussion, teacher's use of technical language, a focus on reasoning and the articulation of ideas verbally or in writing

2 **Understand the use of assessment approaches to meet the needs of numeracy learners**

Areas of numeracy to be assessed: range of topic areas that may be assessed, e.g. number systems, patterns and relationships, measurement and its applications, shape and space, using and applying data to make informed choices, mathematical reasoning; assessment in a topic area, including progression, current knowledge, common errors and misconceptions

Assessment approaches and tools: different types of assessment (diagnostic, formative, summative); assessment methods, e.g. tests, tasks, interviews, work scrutiny, one to one, online, group tasks; use of assessment tools that are fit for purpose, e.g. relate to curriculum standards, exclude the use of skills not being tested, allow numeracy learners to demonstrate knowledge, include contexts relevant to numeracy learners, allow the teacher to give reliable feedback

3 **Understand the use of numeracy teaching approaches and resources to meet the needs of individual numeracy learners**

Teacher pedagogy and the numeracy learner: range of teaching styles, e.g. teacher-centred, learner-centred, interactive, collaborative, direct, indirect, guided, constructivism, mastery; use of resources, e.g. computer and technology based, manipulatives, type of task, equipment; impact of these on numeracy learners, e.g. engagement, understanding, correcting misconceptions, making connections

Technology and the numeracy learner: areas of mathematics that may be explored using technology, e.g. problem solving, functions and graphing, transformations, coordinates, constructions, statistics; types of technologies that may be employed, e.g. projectors, smartboard, tablets, laptops, computers, clickers, mobile phones, calculators, stopwatch, camera, visualizer, activity trackers, dynamic software, programming languages, Excel®,

YouTube™, presentation websites, social media, games, video; impact of these on numeracy learners, e.g. engagement, independence, relevance, understanding

4 **Understand how numeracy can impact on different contexts and subjects**

Numeracy skills and knowledge: skills of number, measures, shape and space, and handling data, e.g. understanding and using mathematical information, calculating and manipulating mathematical information, interpreting results, communicating mathematical information; knowledge of number, measures, shape and space, and handling data, e.g. calculate ratio and direct proportion, find percentage parts of quantities and measurements, recognise and use common 2D representations of 3D objects such as in maps and plans, find the mean, median and mode, and use them as appropriate to compare two sets of data; understand progression through Entry Level 1 to Level 2 of the numeracy curriculum, e.g. count reliably up to 10 items, up to 20 items; count, read, write, order and compare numbers up to 1000; read, write, order and compare numbers, including large numbers; read, write, order and compare positive and negative numbers of any size in a practical context

Links between mathematical and numeracy development and other personal development: personal development in managing own finances, e.g. greater understanding of percentages, compound interest, savings and borrowing links to better financial decision making and greater economic security; personal development in career progression, e.g. improved numeracy skills, providing opportunities to progress at work or confidently apply for other jobs; personal development in further studies, e.g. greater numeracy skills giving access to a greater range of courses

5 **Be able to promote learning support and learner support in numeracy teaching and learning**

Other professionals and their roles: the range of learning establishments, e.g. primary, secondary, further education; commitment of learning establishments to numeracy teaching and where this sits in relation to learners' specialisms, e.g. the curriculum content in primary and secondary and how they relate; the extended professional support network available to teachers and numeracy learners, e.g. Special Educational Needs Coordinator, Learning Support Assistant, Ethnic Minority Support Worker, Dyslexia Specialist, Educational Psychologist; the role and knowledge base of each of these specialist roles, e.g. how and when to involve learning support assistants in planning and delivery, knowledge of the support that can be provided by a special educational needs coordinator, understanding who would know how best to support numeracy learners who have dyslexia or dyscalculia

Effective deployment of human resources: different types of support that may be available, e.g. learning support to develop mathematical concepts, learning support to give learners with English as an additional language improved access to the numeracy content, learning support to enable numeracy learners to manage how dyslexia impacts on their numeracy development; how numeracy learners may benefit from additional support and how teaching support may be shared, e.g. training a learning support assistant in how to deliver numeracy content to a small group who have difficulty with a particular topic, working with an ethnic minority support worker to develop effective strategies for developing the language of mathematics for numeracy learners with English as an additional language

6 **Understand how to liaise with others to promote the inclusion of numeracy and wider skills in learning programmes**

Building professional relationships: foster positive relationships with colleagues through effective communication during meetings, informal discussions and written communication, e.g. acknowledge and consider alternative opinions, support non-mathematics colleagues in developing understanding of mathematical concepts in a supportive manner, action joint responsibilities in a timely and professional manner

Creating cross curricular links between numeracy and other areas of the curriculum: develop opportunities for presenting numeracy in a range of contexts and situations, e.g. science, history, geography, food technology, art, or in work contexts with an educational stakeholder; type of mathematics used in other areas, e.g. ratio and proportion and its links to food technology, reading and interpreting weather charts and its links to geography, symmetry and its links to art; opportunities for presenting wider skills in the numeracy lesson, e.g. language skills through considering how mathematics is expressed verbally, presentation skills through development and delivery of an oral presentation on data handling, estimation skills for making quick mental estimates in daily life

Effective management of joint responsibilities: managing the development of cross-curricular topics with other professionals, e.g. jointly choosing and developing a topic, agreeing and sharing delivery of components, making the links across subjects explicit to the learners; the working educational environment and how best to utilise opportunities to work and communicate with colleagues, e.g. using free periods to meet with colleagues, requesting professional development time, utilising lunch breaks to informally discuss ideas

Essential guidance for tutors

Delivery

Individuals' educational outcomes have been shown to vary depending on a variety of social factors, such as personal, social, economic and ethnicity. Learners could review the current research in this area by reading, for example, the work of Nunes or Ginsburg and Russell, among others. Tutors may then wish to support learners in using UK national statistics to analyse and highlight numeracy learners' educational outcomes based on categories such as free school meals, gender and ethnicity. Comparisons may be drawn between national data and locally available county- or school-level data, and learners may choose to investigate an area of their choice in more depth, designing and carrying out a study on how such factors have impacted on, or continue to impact on, numeracy development in the individual. In particular, learners may wish to consider the relationship between numeracy and literacy levels, comparing, perhaps, available mathematics and English data.

Learners could focus the available research on the language-specific elements of mathematics as a subject, for example the work of Pimm (1987) or Schleppegrell (2007). Attention could be given to how the linguistic requirements for mathematics differ from the use of everyday language, for example the higher lexical density, the greater use of relational processes and long noun phrases. This could extend to working with a colleague in the English department or using a resource such as the National Strategy *Literacy in Mathematics* (DfE, 2004). Consideration could be given to how the suggested teaching approaches relate to the research and to what extent they support the development of numeracy learners' mathematics though the use of language.

Tutors could give learners opportunities to discuss the content of the numeracy curriculum, considering the skills, knowledge and understanding that collectively define numeracy and highlighting possible areas for assessment. A further in-depth look at a given area could include an analysis of progression through the topic and research into common misconceptions as a prerequisite for designing effective assessment activities. Learners should consider a range of diagnostic, formative and summative assessment approaches, considering, for example, how they support initial teacher assessment and future planning. The use of research material, such as the work of Black and Wiliam (1998) could be reviewed as a basis for this work. Tutors may wish to support this process by exploring possible assessment strategies with learners via use of resources, such as *Approaches to the formative and summative assessment of problem solving for functional skills* (Learning and Skills Improvement Service) or the Assessment for Learning module in the National Strategy document *Pedagogy and Practice* (DfE, 2004). Additional activities could focus on a collaborative use of such assessments, where learners and numeracy learners jointly utilise such assessments to clarify the numeracy aspirations of numeracy learners.

Learners should consider a range of teaching and communication approaches and how they impact on the individual needs of numeracy learners. This should include the study of how the use of resources and technology affect outcomes. Tutors could support learners to critically analyse these areas by studying a variety of research documents, such as *Effective Teachers of Numeracy* (Askew et al, King's College London, 1997) and the report by the University of Newcastle, *Ways forward with ICT: Effective Pedagogy using Information and Communications Technology for Literacy and Numeracy in Primary Schools* (Moseley et al, University of Newcastle, 1999). Learners could then explore these ideas through their own teaching by

trialling activities with their own teaching groups, focusing on areas such as engagement, motivation and learning, and comparing their findings with the research evidence.

Learners may want to use the Education Scotland document *National Numeracy Progression Framework* to explore progression through a range of numeracy topics and as a basis for discussing the range of contexts in which numeracy is used in daily and work situations. They may then want to explore this area further, working with numeracy learners to discuss perceptions of where they use mathematics outside the numeracy classroom and what their future mathematical goals are. Learners could then explore the numeracy learning opportunities in other subjects or vocational courses, perhaps with the help of the National Strategy resource *Leading and Managing Numeracy Across the Curriculum* (DfE, 2015). Learners may wish to work collaboratively with colleagues from other subject areas to gain an understanding of where numeracy fits within other subject areas.

Learners may consider their numeracy curriculum in the wider context of the mathematics curriculum – taking into account prior teaching and future educational routes – in order to understand the numeracy needs of past and future studies. An understanding of the roles of other professionals may be obtained through collaborative work with colleagues. For example, learners may wish to consider the Farrell, Balshaw and Polat report *The Management, Role and Training of Learning Support Assistants* (University of Manchester, 1999) while working closely with a learning support assistant in order to understand the practicalities of the role, for example in-class support, withdrawal and joint planning as well as gaining knowledge of teachers' and numeracy learners' views towards the role of the learning support assistant. It may also be appropriate for learners to work-shadow colleagues who work in other specialist areas, such as a special educational needs coordinator, in order to gain a greater knowledge of their role and responsibilities.

Assessment

This section should be read in conjunction with the *Assessment* section at the front of the document.

To pass this unit, the evidence that learners present for assessment must demonstrate that they have met the required standard specified in the learning outcomes and assessment criteria, and the requirements given in *Annexe A – Summary of practice, including observed and assessed practice, requirements*.

Learning outcomes 2 and 4 and assessment criteria 1.1, 5.2 and 6.1 could be assessed through an action research project that considers numeracy learners' past, present and future. The project could start with a critical analysis of the research into the impact that background factors, such as economic and social status, have on numeracy development. Learners could then work with a numeracy learner to develop an understanding of their aspirations and progression hopes, exploring how numeracy would be linked to their personal development in this context. Having identified the numeracy elements necessary to numeracy learners' personal development and aspirations, learners could identify the numeracy skills and progression present in this topic area. This could form a basis to develop diagnostic assessments to assess numeracy learners' current understanding and future development needs. Working with a colleague from another subject or vocational setting, the numeracy needs of numeracy learners could be considered in relation to how they could be jointly developed across the two subject areas. Following delivery of the teaching element, learners could again work with numeracy learners to assess progress made and consider how this relates to numeracy learners' personal development. This research project could be written up as a report of no more than 6000 words.

Learners should be assessed on their critical assessment of the research evidence into the effects of the socio-economic and political factors on numeracy development in the individual. They should demonstrate the ability to isolate the numeracy skills present in other contexts and subjects and identify the numeracy skills, knowledge and understanding that can be assessed in this area. Learners should explain the impact of making the links between numeracy and personal development explicit and how assessment can be used to highlight aspirations. Learners should include an analysis of the diagnostic assessment approaches, its strengths and weaknesses, as well as the other assessment tools used throughout the teaching process and in the final interview. The report should include an analysis of how teaching and learning opportunities can be shared among learning professionals, and an analysis of the process of liaising with a colleague, its benefits and difficulties.

Assessment criteria 1.2, 1.3 and 6.2 could be assessed through a project researching the literacy demands of the mathematics classroom. The project could begin by comparing individuals' numeracy and literacy levels on either a national or local level to highlight any possible trends. Learners could include an analysis of the theoretical research relating to language-specific issues inherent in the teaching of mathematics and the suggested approaches in tackling such difficulties. This introduction could lead to work with a colleague from the English department to develop and trial teaching activities aimed at promoting numeracy and processing skills through improving knowledge of the use of language. This could be written up as a report of no more than 3000 words.

Learners should be assessed on their understanding of the literacy demands specific to the mathematics classroom and how this may impact on numeracy development. Analysis of the language-focused teaching activities should discuss how varying

approaches impacted on numeracy development and processing skills. The report should also include a section on the process of liaising with a colleague from another area and how it facilitated the inclusion of the teaching of elements of literacy as an integral part of the mathematical development process.

Learning outcome 3 and assessment criterion 5.1 could be assessed through a collaborative working project with a learning support assistant into meeting the needs of learners through use of teaching approaches and technological resources. The project could take as its starting point a discussion between the two professionals of the learning support assistant's areas of responsibility and how these compare to nationally accepted responsibilities. This discussion could lead to an agreement on the focus for the project (numeracy content, range of teaching approaches and types of technology) and the role of the learning support assistant in the project. The project could focus on the critical analysis of the approaches and resources used in relation to motivating learners and meeting their individual needs. The project could be written up as a report of no more than 2500 words.

Learners should be assessed on their analysis of the impact of the various approaches and resources used on meeting the needs of individual numeracy learners and how the use of technology impacted on motivation and engagement among the numeracy learners. The report should contain references to the different roles of the teacher and learning support assistant in the plan-teach-review cycle and show an understanding of the boundaries between the role of teacher and support staff.

Essential resources

There are no essential resources required for this unit.

Indicative resource materials

Books

Black P and Wiliam D – *Inside the Black Box: Raising Standards Through Classroom Assessment* (GL Assessment, 2005) ISBN 9780708713815

Dweck C – *Self Theories: Their Role in Motivation, Personality and Development* (Lillington NC, Psychology Press, Taylor & Francis, 2000) ISBN 9781841690247

Lee C – *Language for Learning Mathematics: Assessment for Learning in Practice* (Buckingham, Open University Press, 2006) ISBN 9780335219889

Journals

Ginsburg H and Russell R – *Social class and racial influences on early mathematical thinking* (Monographs of the Society for Research in Child Development, 46 (6) pp1–69, 1981)

Meiers M – *THE DIGEST 2010/2: Language in the mathematics classroom (*NSW Institute of Teachers, 2010)

Schleppegrell M – *The linguistic challenges of mathematics teaching and learning: A research review* (Reading & Writing Quarterly, 23: 139–159, 2007)

Websites

www.educationscotland.gov.uk	Professional resources to support teachers of numeracy
maths.excellencegateway.org.uk	Professional development and resources for practitioners
www.nationalstemcentre.org.uk	Access to the National Strategy resources and other research and support materials

Other resources

Approaches to the formative and summative assessment of problem solving for functional skills (Learning and Skills Improvement Service)

Askew M et al – *Effective Teachers of Numeracy* (King's College, University of London, 1997)

Chanda N et al – *Maths4Life: Integrating Formative and Diagnostic Assessment Techniques into Teachers' Routine Practice in Adult Numeracy* (NRDC, 2007)

Farrell P, Balshaw M and Polat F – *The Management, Role and Training of Learning Support Assistants* (University of Manchester, 1999)

Moseley D et al – *Ways forward with ICT: Effective Pedagogy using Information and Communications Technology for Literacy and Numeracy in Primary Schools* (Newcastle University, 1999)

National Numeracy Progression Framework (Education Scotland, 2015)

National Strategy – *Literacy and Learning in Mathematics* (DfE, 2004)

National Strategy – *Literacy in Mathematics* (DfE, 2004)

National Strategy – *Pedagogy and Practice* (DfE, 2004)

Nunes T et al – *Development of Maths Capabilities and Confidence in Primary School* (University of Oxford, 2009) ISBN 9781847754578

Professional learning paper – *Significant Aspects of Learning: Assessing progress and achievement in Numeracy and Mathematics* (Education Scotland, 2015)

Unit 3: Numeracy Knowledge and Understanding

Unit reference number: H/505/0764
QCF Level: 5
Credit value: 15
Guided learning hours: 40

Unit introduction

In this unit you will have the opportunity to explore mathematics from its historic viewpoint and social development, including how this has impacted on curriculum development over time. The unit aims to give you an understanding of attributes and procedures in mathematics, such as the use of mathematical modelling for statistical and numerical problems and the variety of ways in which mathematics is communicated. It looks at the learning theories and their impact on mathematics and numeracy teaching, as well as how social perceptions may affect mathematics learning.

In this unit you will have the opportunity to learn about how mathematical concepts build on each other and interconnect, raising issues of the roots of misconceptions and the idea of treating mathematics as a holistic discipline rather than a set of disconnected strategic approaches. In addition, this unit will enable you to consider how mathematical problems and procedures may be deconstructed, how solutions are presented using a variety of mathematical communication systems and the role that units of measurement and statistical analysis play in mediating between mathematics and the real-life context. This unit will allow you to consider the current mathematical climate, including how learning theories and social changes have contributed to current and past teaching and curriculum policies. The unit will also give you opportunities to consider the mathematical necessities of living in today's world and how people view mathematics and numeracy today.

Learning outcomes and assessment criteria

To pass this unit, the evidence that learners present for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

On completion of this unit a learner should:

Learning outcomes	Assessment criteria
1 Understand fundamental attributes of mathematics and numeracy	1.1 Review the historic and cultural development of mathematics 1.2 Analyse the language and concepts associated with number systems 1.3 Analyse common errors and misconceptions in mathematics and possible reasons why they occur 1.4 Analyse the techniques used in mathematics and numeracy for conceptual linkages
2 Understand the attributes of procedures in mathematics and numeracy	2.1 Analyse the activities, processes and stages in mathematical problems and investigations 2.2 Evaluate written, mental and diagrammatic mathematical strategies, analysing the associated metalanguage 2.3 Analyse the use, interpretation and representation of data 2.4 Evaluate the use of measurement systems in problem solving, including: • definition • conversion • representation
3 Understand how learning theories and the origins and status of mathematics impact on numeracy teaching	3.1 Analyse the effect of the origins and status of mathematics knowledge on mathematics and numeracy curriculum development 3.2 Analyse how teaching and learning theories underpin numeracy teaching and learning
4 Understand the links between the roles and perceptions of mathematics and numeracy in society	4.1 Analyse the role of mathematics and numeracy in society 4.2 Evaluate perceptions of mathematics and numeracy, including: • popular views • learner attitudes • trends in learner attainment

Unit content

1 **Understand fundamental attributes of mathematics and numeracy**

Development of mathematics in historical and cultural context: how social factors impact on mathematical discoveries, e.g. how the development of civilisation has impacted on the need for rough, and then standardised, units of measurement and how the need for carrying out calculations with numbers required the concepts of place value and the number zero; variations between known mathematical content in distinct cultures or eras; fundamental attributes of mathematics, e.g. formation of systems of measurement, construction of calendars and the measure of time

Number systems: from different cultures such as Babylonian, Roman, Egyptian or Arabic; how these allow for an analysis of how number may be expressed verbally or in written form, displaying differences and similarities that highlight the concepts and language of mathematics; different number bases, such as binary, ternary, octal and hexadecimal; fundamental properties of place value in number systems; number types within the set of real numbers, e.g. natural numbers, integer, rational and irrational numbers; their inherent properties, differences and interrelationships

Common errors and misconceptions in mathematics: range of misconceptions across topic areas, e.g. number, measure, shape, space and algebra; analysis of the nature of misconceptions and their origins, e.g. linked to prior learning, day-to-day experiences, incorrect generalisation of prior knowledge, support prior learning, interfere with learning and are stable, widespread and resistant to change

Using conceptual linkages in teaching and learning: recognising and using connections across topics, e.g. number, algebra, shape, space, measure, statistics; exploring proportionality in the interpretation of statistics; making connections between the symbolic and graphical representations of mathematics and the written and spoken language, such as the formula, diagram and language associated with finding the area of a triangle; connections between abstract ideas and real-life contexts, such as ordering decimals or ordering people according to their height

2 **Understand the attributes of procedures in mathematics and numeracy**

Using and applying mathematics: problem-solving and reasoning skills, e.g. selecting efficient and appropriate strategies, breaking down complex calculations, making mental estimates, the use of algebra to make generalisations, use of deductive reasoning, recognising the limitations of assumptions, the ability to make and test conjectures; mathematical modelling using the modelling cycle, e.g. real-life problem, simplified mathematical problem with assumptions, solution of simplified problem, interpretation of solution in relation to original problem

Communicating mathematically: various ways in which mathematics is communicated, e.g. symbols, notation, diagrams, conventions, verbal communication, written text; how these methods support and interact with each other, e.g. algebraic, diagrammatical and written definitions of Pythagoras' theorem

Data Handling and Statistical Analysis: critical analysis of use of statistics, e.g. effectiveness of design of investigation in relation to problem, source, type and quantity of data used, choice of mathematical representations used, accuracy of any claims made in relation to the presented data, misrepresentation or false claims

Systems of measurements and their representations: distinction between types of quantities that can be measured, e.g. length, weight, capacity, money, temperature, volume; the range of standard units of measurement available for measuring these quantities, e.g. miles, grams, litres, pounds, Fahrenheit, cubic metres; different units of measure for the same quantity and their conversion facts, e.g. inches, feet, yards, centimetres, metres, kilometres; the selection and use of correct and relevant units when presenting solutions to real-life problems, e.g. using miles or kilometres to represent distance covered during a car journey

3 **Understand how learning theories and the origins and status of mathematics impact on numeracy teaching**

Social changes and their impact on curriculum development: historic development, e.g. Ancient Greece, Roman Empire, inclusion in a classical education, impact of Euclid's work on the teaching of geometry, impact of the industrial revolution; impact of research on curriculum development, e.g. mathematical problem solving, mathematical language, use of technology in mathematics teaching, misconceptions; current social needs, e.g. managing with daily mathematics, filtering and organising information, use of computers and digital technology

Theory and pedagogy: philosophy and psychology as basis for learning theories, e.g. the work of Locke, Watson, Skinner, Kohler, Piaget, Dewey, Montessori; learning theories and their derivatives, e.g. behaviourism, cognitivism, constructivism, humanism; teaching approaches and their links to learning theories, e.g. direct instruction, experimental learning, model building, debates, drill and practice

4 **Understand the links between the roles and perceptions of mathematics and numeracy in society**

The role of mathematics: use of mathematics in a range of fields, e.g. healthcare, economics, weather, transport, holiday industry, construction, fitness; individual and social cost of poor numeracy skills, e.g. impact on employment, health, wages, school exclusions, the economy, crime; the individual's numeracy level and their ability to function on a daily basis, e.g. the types of tasks that can or cannot be performed by an adult with numeracy understanding at Entry Level 1, 2 or 3 of the adult numeracy curriculum

Social and personal perceptions of mathematics: how the general public views numeracy and mathematics in the UK, e.g. national levels and abilities, teaching methods, social need for numeracy, comparison to other countries; how learners' perceive mathematics and numeracy, e.g. their personal ability, teaching methods, their aspirations; trends and comparisons, e.g. mathematics and numeracy attainment across past years, comparisons to other countries

Essential guidance for tutors

Delivery

Mathematics has a rich history and its development varies across cultures. Tutors may wish to support learners in researching the historical development of a given area of mathematics across both time and cultures. Comparisons could be made between the concepts and language used in the various cultures, their similarities and differences and their comparison with our current knowledge and conventions. Learners could then extend their investigation to include a review of the research evidence that explores misconceptions and conceptual understanding related to this area of mathematics. Learners may then choose to explore some of these areas in their own classroom practice, critically analysing the impact and outcomes of a range of activities. For example, learners could use sections of the Department for Education and Skills Standards Unit *Improving Learning in Mathematics: Challenges and Strategies* (DfE, 2005) as a basis for exploring how to tackle misconceptions in the classroom.

Tutors could give learners opportunities to discuss the processes and stages required to successfully carry out mathematical or statistical investigations. Learners could compare the 'Using and Applying' objectives contained in the 1999 Mathematics National Curriculum for England with the new 'Working Mathematically' objectives contained in the current National Curriculum: *National curriculum in England: mathematics programmes of study* (DfE, 2014). Learners could discuss their opinion of the differences between these documents along with their experiences of carrying out mathematical investigations. Tutors could then lead learners to consider the mathematical content, giving them with the opportunity to explore the range of written, mental and diagrammatic strategies that may be employed in the calculation processes. Learners may consider the efficiency of any given strategy in relation to a range of problems. For example, when considering subtraction calculations, learners could consider the most efficient strategy for solving 372 – 199, 372 – 186 and 372 – 469, including mental and written methods and the use of a number line. Learners may then wish to trial these strategies in the classroom to explore how numeracy learners respond to the range of strategies and calculations.

People use data and statistics frequently in their daily life and so it is important to have a good understanding of the way data is handled. Learners may like to consider how data is used in a range of situations, focusing, for example on how statistics are used by a range of organisations, including private companies, charities and governments. Learners should be encouraged to consider the purpose of these statistics, their presentation and any interpretation that is derived from them. Learners could then consider the necessary skills and knowledge that is required to critically analyse the range of information in statistical form that is regularly used in today's society.

While a good understanding of data handling is now an essential part of life, this has not always been the case. Learners could explore how the use of mathematics in our society has changed over the centuries and how this change has been reflected in the development of the mathematics and numeracy curriculums. Learners could, for example, consider the current content of the different levels of the adult numeracy curriculum and how they relate to the mathematical demands of living and working in Britain today.

Tutors could direct learners to research influential learning theories, such as behaviourism, cognitivism and constructivism. Learners could then observe a range of numeracy lessons during which they analyse the teaching style employed in relation to the learning theories they have studied. Learners could then be supported in analysing their own teaching style and beliefs in relation to the various learning theories and numeracy-specific research, such as *Effective Teachers of Numeracy* (Askew et al, 1997).

Tutors could support learners in carrying out research into current social attitudes towards numeracy, such as perceptions of importance, personal ability, learning experiences, levels of attainment and whether people feel they have the necessary mathematical skills to manage on a daily basis.

Assessment

This section should be read in conjunction with the *Assessment* section at the front of the document.

To pass this unit, the evidence that learners present for assessment must demonstrate that they have met the required standard specified in the learning outcomes and assessment criteria, and the requirements of the document in *Annexe A – Summary of practice, including observed and assessed practice, requirements*.

Learning outcome 1 could be assessed through an investigation based on both theoretical research and learners' own classroom experience. The investigation could focus on an area of number, its historic development, its inherent attributes and the problems learners experience in gaining cognitive understanding in this area. Learners could then explore the occurrence of such misconceptions among their own numeracy learners and the effectiveness of various teaching strategies in supporting numeracy learners in developing a more secure understanding of mathematics. This investigation can then be written up as a report of no more than 3000 words.

Learners should be assessed on their knowledge of their chosen area of number, including historical development, language, concepts, known misconceptions, their causes and associated teaching strategies. Consideration should be given to current research evidence as well as to the empirical evidence gained during the investigation.

Learners should also be assessed on their analysis of their investigation findings and how this has improved their own professional practice. Learners should demonstrate knowledge of a specific area of number and be able to analyse ways in which the findings of the investigation can be used to develop their own professional practice.

Learning outcome 2 could be assessed through a written evaluation of up to 2000 words in which learners demonstrate their understanding of the inherent problems that numeracy learners experience when solving a complex mathematical problem. The evaluation could be based on the analysis of numeracy learners' attempts to solve a complex problem and the strategies and mathematical procedures that they employ.

Learners should be assessed on their analysis of the strengths and weaknesses of the techniques employed by numeracy learners, including their modelling and reasoning skills, their efficient use of mathematical strategies and their effective use of data and measuring systems. Learners should include an analysis of why numeracy learners may have had difficulty with certain areas of the investigation and how various teaching strategies may impact on the outcomes. This analysis should be based on a good knowledge of mathematical modelling techniques and effective strategies, alongside the empirical evidence contained in the numeracy learners' mathematical work.

Learning outcomes 3 and 4 could be assessed through an observed presentation on the relationship between social necessity and the mathematics and numeracy curriculum content, both past and present. Following this presentation, learners could lead a group discussion on personal views and attitudes to mathematics in general and to learning experiences in the classroom in particular. Learners could then produce a short analytical report of no more than 2500 words based on their findings, including some analysis of whether expressed views on learning experiences may be representative of how learning theories have impacted on mathematics and numeracy teaching.

Learners should be assessed on their understanding of the social need for, and role of, mathematics and numeracy in present and past societies and how this impacts on curriculum development and content. Learners should include an analysis of the prevalent learning theories and consider if personal views raised during the discussion are indicative of a classroom experience of teaching styles based on distinct learning theories.

Essential resources

There are no essential resources required for this unit.

Indicative resource materials

Books

Fauvel J and Gray J – *The History of Mathematics: A Reader* (Palgrave Macmillan, 1987) ISBN 9780333427910

Gates P – *Issues in Mathematics Teaching* (Routledge, 2001) ISBN 9780415238656

Howson G, Keitel C and Kilpatrick J – *Curriculum Development in Mathematics* (Cambridge University Press, 2009) ISBN 9780521270533

Merzbach U and Boyer C – *A History of Mathematics*, 3rd Edition (John Wiley and Sons Ltd, 2011) ISBN 9780470525487

Ryan J and Williams J – *Children's Mathematics 4–15: Learning from Errors and Misconceptions* (Open University Press, 2007) ISBN 9780335220427

Turner S and McCullouch J – *Making Connections in Primary Mathematics* (Routledge, 2004) ISBN 9781843120889

Journals

Askew M et al – *Effective Teachers of Numeracy* (Report of a study carried out for the Teacher Training Agency by the School of Education, King's College, London, 1997)

International Journal of Science and Mathematics Education, June 2004, Volume 2, Issue 2, pp 287–304. Tzur R and Simon M – *Distinguishing Two Stages of Mathematics Conceptual Learning*

Nardi E and Steward S – *I could be the best mathematician in the world... if I actually enjoyed it*: *part 1* (Mathematics Teaching 179: 41–44, 2002)

Nardi E and Steward S – *I could be the best mathematician in the world... if I actually enjoyed it: part 2* (Mathematics Teaching 180: 4–9, 2002)

Nardi E and Steward S – *Is Mathematics T.I.R.E.D.? A Profile of Quiet Disaffection in the Secondary Mathematics Classroom* (British Educational Research Journal, 29(3), 345–367, 2003)

The Journal of the Learning Sciences, Vol. 3, No. 2. (1993–1994), pp. 115–163. Smith J, diSessa A, Roschelle J – *Misconceptions Reconceived: A Constructivist Analysis of Knowledge in Transition*

Tzur R et al – *Distinguishing Schemes and Tasks in Children's Development of Multiplicative Reasoning* (PNA, 7(3), 85–101, Universidad de Granada, 2013)

Websites

www.archive.org/details/AHistoryOf Mathematics	Online copy of *A History of Mathematics* by Carl B. Boyer
www.ccea.org.uk	Council for the Curriculum, Examinations and Assessment
www.gov.uk	Statutory programs of study
www.musicmathsmagic.com/page4/files/ EffectiveTeachersofNumeracy.pdf	Askew et al – *Effective Teachers of Numeracy* (1997)
www.nationalstemcentre.org.uk	Access to the Standards Units materials
www.nottingham.ac.uk/csme/meas/papers/ rogers.html	Rogers – *Society, Mathematics and the Cultural Divide: Ideologies of Policy and Practice 1750 – 1900*
www.nrich.maths.org	NRICH team – *Changing Perceptions* (2001)
www.people.ucsc.edu	*The Journal of the Learning Sciences – Misconceptions Reconceived: A Constructivist Analysis of Knowledge in Transition*
www.pna.es	Tuzur et al – *Distinguishing Schemes and Tasks in Children's Development of Multiplicative Reasoning*

Other resources

Department for Education Standards Unit – *Professional development* 2 (DfE, 2000)

Department for Education Standards Unit – *Improving Learning in Mathematics: Challenges and Strategies* (DfE, 2005)

Further information and useful publications

To get in touch with us visit our 'Contact us' pages:

- Edexcel, BTEC and Pearson Work Based Learning contact details: qualifications.pearson.com/en/support/contact-us.html
- books, software and online resources for UK schools and colleges: www.pearsonschoolsandfecolleges.co.uk

Key publications

- *Adjustments for candidates with disabilities and learning difficulties, Access Arrangements and Reasonable Adjustments, General and Vocational qualifications* (Joint Council for Qualifications (JCQ))
- *Supplementary guidance for reasonable adjustments and special consideration in vocational internally assessed units* (Pearson)
- *General and Vocational qualifications, Suspected Malpractice in Examinations and Assessments: Policies and Procedures* (JCQ)
- *Equality Policy* (Pearson)
- *Recognition of Prior Learning Policy and Process* (Pearson)
- *UK Information Manual* (Pearson)
- *BTEC UK Quality Assurance Centre Handbook*.

All of these publications are available on our website.

Publications on the quality assurance of BTEC qualifications are also available on our website. Our publications catalogue lists all the material available to support our qualifications. To access the catalogue and order publications, please visit our website.

Additional resources

If you need further learning and teaching materials to support planning and delivery for your learners, there is a wide range of BTEC resources available. Any publisher can seek endorsement for their resources and, if they are successful, we will list their BTEC resources on our website.

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- building your team and teamwork skills
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- building in effective and efficient quality assurance systems.

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- Ask the Expert: submit your question online to our Ask the Expert online service and we will make sure your query is handled by a subject specialist.

Please visit our website at qualifications.pearson.com/en/support/contact-us.html

Annexe A – Summary of practice, including observed and assessed practice, requirements

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

Unit	Practice requirement	Observation and assessment of practice requirement	Notes on requirements
Numeracy teaching and learning Level 5	Yes	Yes	The minimum number of practice hours for this unit is not specified. However, it is not possible to achieve this unit without completing some hours of practice. Practice must be in teaching and learning environments with a numeracy context, and should involve working with groups of learners. Practice must be undertaken in at least two of the three levels of the numeracy curriculum – Entry Level and one other. To be eligible for the award of credit for this unit, trainee teachers must have evidence of a minimum of four assessed observations of practice at the required standard, totalling a minimum of four hours. All four of these observations must be in teaching and learning environments and in a numeracy context. Assessed observations should include at least one numeracy observation at Entry Level. There is no transfer of practice, or of observed and assessed practice, from a previously achieved Level 4 education and training qualification.
Numeracy and the Learners Level 5	No	No	n/a
Numeracy Knowledge and Understanding Level 5	No	No	n/a

Annexe B – Observation recording requirements

Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF)

To successfully achieve the Pearson BTEC Level 5 Diploma in Teaching Mathematics: Numeracy (QCF), learners must complete a minimum of 50 hours of teaching practice in a numeracy teaching and learning environment. There must be a minimum of four observations totalling a minimum of four hours, and any single observation session must be of a minimum of 30 minutes. There is a requirement to evidence working with groups of learners to achieve this qualification. In addition, practice must be undertaken in at least two of the three levels in the numeracy curriculum – Entry Level and one other (Level 1 or Level 2).

All four observations must be linked to *Unit 1: Numeracy Teaching and Learning*. To be eligible for the award of credit for this unit, trainee teachers must have evidence of a minimum of four assessed observations of practice at the required standard, totalling a minimum of four hours. All four of these observations must be in teaching and learning environments and in a numeracy context. Assessed observations should include at least one numeracy observation at Entry Level.

Summaries of the Ofsted grading criteria are given on the following pages.

As grading of observations can be viewed as intimidating by learners, grading should be used only later on in the programme. This allows learners time to practise and develop skills. If learners fail to demonstrate at least grade 2 characteristics, a further observation will be required, once appropriate feedback and support has been given.

A pro forma for the observed teaching report is provided in this annexe.

Summary of Ofsted grading criteria – grade 1 (Outstanding)

Planning and preparation	Learning and teaching	Assessment of learning
Outstanding		
• Teachers have consistently high expectations of all learners' attitudes to learning and learners are set challenging targets to achieve. • Teachers plan learning sessions and assessments very effectively so that all learners undertake demanding work that helps them to realise their potential. • Teachers effectively identify and plan support for learners who require additional support for their learning.	• Teachers promote curiosity and interest in their learners who are keen to learn. Teachers encourage learners to seek out and use new information to develop, consolidate and deepen their knowledge, understanding and skills. • Teachers have excellent subject knowledge and motivate and engage learners who enjoy the work they complete. • Teachers promote, where appropriate, English, mathematics, ICT and employability skills exceptionally well. • Teachers set work that consolidates learning, deepens understanding and develops skills, and fully prepares learners for their next steps. • Teachers are quick to challenge stereotypes and the use of derogatory language. • Resources and teaching strategies reflect and value the diversity of learners' experiences and give learners a comprehensive understanding of people and communities beyond their immediate experience.	• Teachers check learners' understanding systematically and effectively, offering clearly directed and timely support that has a notable impact on improving learning. • Teachers gather a useful range of accurate assessment information and use this to give learners incisive feedback about what they can do to improve their knowledge, understanding and skills. Learners are committed to taking these next steps and their work shows that almost all are making substantial and sustained progress.

Summary of Ofsted grading criteria – grade 2 (Good)

Planning and preparation	Learning and teaching	Assessment of learning
Good		
• Teachers plan and set work that builds on previous learning, extends learners' knowledge and understanding and develops their skills to ensure that they are prepared for their future. • Teachers use assessment information well to plan activities in which learners undertake demanding work that helps them to make strong progress. They identify, plan and support effectively those learners who have additional learning needs.	• Teaching challenges learners and enables them to develop, consolidate and deepen their knowledge, understanding and skills. • Teachers develop, where appropriate, learners' English, mathematics, ICT and employability skills to prepare them for their future progression. • Teachers challenge stereotypes and the use of derogatory language. • Teachers promote equality of opportunity and diversity in teaching and learning. • Teachers listen to, carefully observe and skilfully question learners during learning sessions. They reshape tasks and explanations and give feedback to tackle misconceptions and build on learners' strengths. This has a positive impact on learning.	• Teachers give learners feedback that details what they need to do to improve and many learners act on this to make improvements. • Most learners want to know how to improve their learning and act on feedback to help them to improve. • Teachers assess learners' knowledge and understanding frequently to ensure that they are making expected progress.

Summary of Ofsted grading criteria – grade 3 (Requires improvement)

Planning and preparation	Learning and teaching	Assessment of learning
Requires improvement		
• Teaching, learning and assessment are not yet good.	• Teaching, learning and assessment are not yet good.	• Teaching, learning and assessment are not yet good.

Summary of Ofsted grading criteria – grade 4 (Inadequate)

Planning and preparation	Learning and teaching	Assessment of learning
Inadequate		
• Teaching and/or assessment is poorly planned.	• Learners or particular groups of learners are making inadequate progress because teaching does not develop their knowledge, understanding and skills sufficiently. • Learners are not developing English, mathematics, ICT or employability skills adequately to equip them for their future progression. • Teachers do not promote equality of opportunity or understanding of diversity effectively and this disadvantages individuals or groups of learners. • As a result of weak teaching, learning and assessment over time, learners or groups of learners make insufficient progress and are unsuccessful in attaining their learning goals and progressing to their planned next steps. • Teachers lack expertise and the ability to promote learning and learners do not see its relevance to their everyday lives and planned next steps.	• Weak assessment practice means that teaching fails to meet learners' needs.

Annexe C – Graded observation pro forma

Observation report									
Teacher									
Observer				Learners on register			Present		
Date		Time from			Time to				
Subject/topic									
Location				Duration					
No. of learners with additional support needs					No. of support staff				
Context of learning									
1 = Outstanding, 2 = Good, 3 = Requiring improvement, 4 = Inadequate									

Planning and preparation	Grade	1	2	3	4
Rationale for grade:	Criteria				Met
	Plan is clear and relevant				
	Outcomes identified				
	Teaching methods identified				
	Learning activities identified				
	Learner needs identified				
	Assessment planned				
	Appropriate, sufficient resources				
	Learner support is planned				

Learning and teaching	Grade	1	2	3	4
Rationale for grade:	Criteria				Met
	Purpose of learning introduced				
	Assessment of prior learning				
	Effective communication				
	Inclusive delivery and resource use				
	Effective interaction with learners				
	Management of behaviour				
	Management of learner support				
	Effective motivation/challenge				
	Clear evidence of active learning				
	Individual learner needs recognised				
	LLN and ICT* skills used in context				
	Opportunities for learner feedback				
	Effective learning summary				

Assessment of learning	Grade	1	2	3	4
Rationale for grade:	Criteria				Met
	Effective formative assessment				
	Effective summative assessment				
	Differentiated assessment				
	Effective feedback methods used				
	Effective recording of assessment				

*Literacy, Language, Numeracy, ICT

Observation summary review
Progress towards meeting action points identified in previous observations
Areas for improvement

The learner has, on the basis of the observed session, demonstrated the characteristics of grade _____	Grade	1	2	3	4

Observer's signature _____

Date _____

Annexe D – Session plan pro forma

Learning group		**Teacher**		**Session no.**		**Date**		**No. of learners**	
Subject/topic				**Location**					
Learners with additional learning needs – support requirements									
Learner/s	**Support strategy for session**						**Support staff name/s**		
What is the session aim?									
What will be learned? (Learning outcomes) Include any differentiated outcomes for learners with additional learning needs									

What will I teach and how? Include opportunities for literacy, language, numeracy and ICT		
Timing	**Activity and resource**	**Teaching method**
How will I check learning? (Assessment methods) Include any differentiated methods for learners with additional learning needs		
What evidence will be produced?		
Resource arrangements (Room booking, equipment hire, transport, etc.)		

Self-reflective evaluation of session
What worked well?
What could be improved?
Unexpected outcomes
Reminders for next session

Annexe E – Portfolio building record sheets

Using the table below, centres can provide references to where each assessment criterion can be evidenced in the learner's portfolio.

Additionally, in each assignment submitted, mapping of the tasks to the assessment criteria must be included. The assessment tasks should cover all the assessment criteria of the unit at a particular level.

Unit 1: Numeracy Teaching and Learning

Learning outcomes		Assessment criteria		Portfolio reference	Date
1	Be able to plan inclusive numeracy teaching and learning	1.1	Plan numeracy teaching and learning to meet the needs of numeracy learners and curriculum requirements using: • own specialist numeracy knowledge • the results of numeracy initial and diagnostic assessment		
		1.2	Select numeracy teaching approaches and resources to meet the individual needs of numeracy learners		

Learning outcomes		Assessment criteria		Portfolio reference	Date
2	Be able to assess learners' numeracy knowledge, understanding and skills	2.1	Carry out initial and diagnostic assessment to identify learners' existing mathematical and numeracy skills, knowledge, understanding and aspirations		
		2.2	Involve learners in the processes of assessment and target setting		
		2.3	Use numeracy assessment tools to measure the development of learners' numeracy skills		
		2.4	Record numeracy assessment information in accordance with organisational systems		
3	Be able to deliver inclusive numeracy teaching and learning	3.1	Maintain a supportive and challenging numeracy learning environment that motivates learners and meets their needs		
		3.2	Use numeracy teaching approaches and resources to develop the numeracy skills of individual learners		

Learning outcomes		Assessment criteria		Portfolio reference	Date
4	Be able to use communication strategies and techniques in numeracy learning	4.1	Devise communication strategies to enable learners to develop numeracy language and vocabulary		
		4.2	Use communication strategies to enable learners to develop numeracy language and vocabulary		
		4.3	Use collaborative learning techniques to improve numeracy learning and problem solving		
		4.4	Use communication strategies to develop the literacy and language skills needed by learners to develop their numeracy and problem-solving skills		
5	Be able to evaluate own practice in numeracy teaching	5.1	Reflect on own practice in numeracy teaching, drawing on: • own research in numeracy teaching and learning • learners' assessment data • feedback from learners • feedback from colleagues		
		5.2	Identify ways to improve own practice in numeracy teaching		

I certify that the assessments are all my own work and any sources are duly acknowledged.

Learner signature _____ Date _____

I confirm that the minimum number of credits at the appropriate level has been achieved in order for a claim for certification to be made.
I can confirm that the credit has been achieved from the correct combination of mandatory units as specified in the Rules of Combination.

Assessor signature _____ Date _____

Internal Verifier signature (if sampled) _____ Date _____

Unit 2: Numeracy and the Learners

Learning outcomes		Assessment criteria		Portfolio reference	Date
1	Understand the factors that influence the development and progression of numeracy learners	1.1	Analyse the impact of personal, social, economic and political factors on the development and progression of numeracy learners		
		1.2	Explain the impact of learners' literacy and language skills on the development and progression of their numeracy skills		
		1.3	Explain how differing communication approaches can affect the learning of numeracy processes and skills		
2	Understand the use of assessment approaches to meet the needs of numeracy learners	2.1	Identify the skills, knowledge and understanding that can be assessed in numeracy		
		2.2	Analyse approaches to initial and diagnostic assessment to identify the mathematics and numeracy skills and aspirations of numeracy learners		
		2.3	Analyse the use of assessment tools in numeracy teaching and learning		

Learning outcomes		Assessment criteria		Portfolio reference	Date
3	Understand the use of numeracy teaching approaches and resources to meet the needs of individual numeracy learners	3.1	Analyse numeracy teaching approaches and resources, including technologies, for suitability in meeting individual learners' needs		
		3.2	Analyse the impact of using technology on learner engagement, motivation and success in numeracy teaching and learning		
4	Understand how numeracy can impact on different contexts and subjects	4.1	Identify the numeracy skills and knowledge needed by learners across contexts and subjects, and for progression purposes		
		4.2	Explain the importance of encouraging learners to make links between their mathematical and numeracy development and their other personal development		
5	Be able to promote learning support and learner support in numeracy teaching and learning	5.1	Explain the boundaries between own specialist area and those of other specialists and practitioners		
		5.2	Analyse numeracy learning opportunities to determine how teaching and support needs may be shared between learning professionals		

Learning outcomes		Assessment criteria		Portfolio reference	Date
6	Understand how to liaise with others to promote the inclusion of numeracy and wider skills in learning programmes	6.1	Explain how to liaise with other professionals to provide specialist knowledge of how to include numeracy in vocational and other subject areas		
		6.2	Explain how to liaise with other professionals to promote the inclusion of wider skills in own specialist area		

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Assessor signature _____ Date _____

Internal Verifier signature (if sampled) _____ Date _____

Unit 3: Numeracy Knowledge and Understanding

Learning outcomes		Assessment criteria		Portfolio reference	Date
1	Understand fundamental attributes of mathematics and numeracy	1.1	Review the historic and cultural development of mathematics		
		1.2	Analyse the language and concepts associated with number systems		
		1.3	Analyse common errors and misconceptions in mathematics and possible reasons why they occur		
		1.4	Analyse the techniques used in mathematics and numeracy for conceptual linkages		

Learning outcomes		Assessment criteria		Portfolio reference	Date
2	Understand the attributes of procedures in mathematics and numeracy	2.1	Analyse the activities, processes and stages in mathematical problems and investigations		
		2.2	Evaluate written, mental and diagrammatic mathematical strategies, analysing the associated metalanguage		
		2.3	Analyse the use, interpretation and representation of data		
		2.4	Evaluate the use of measurement systems in problem solving, including: • definition • conversion • representation		
3	Understand how learning theories and the origins and status of mathematics impact on numeracy teaching	3.1	Analyse the effect of the origins and status of mathematics knowledge on mathematics and numeracy curriculum development		
		3.2	Analyse how teaching and learning theories underpin numeracy teaching and learning		

Learning outcomes		Assessment criteria		Portfolio reference	Date
4	Understand the links between the roles and perceptions of mathematics and numeracy in society	4.1	Analyse the role of mathematics and numeracy in society		
		4.2	Evaluate perceptions of mathematics and numeracy, including: • popular views • learner attitudes • trends in learner attainment		

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Learner signature _____ Date _____

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Assessor signature _____ Date _____

Internal Verifier signature (if sampled) _____ Date _____

Annexe F – Wider curriculum mapping

BTEC Level 5 qualifications give learners opportunities to develop an understanding of spiritual, moral, ethical, social and cultural issues as well as an awareness of citizenship, environmental issues, European developments, health and safety considerations and equal opportunities issues.

Spiritual, moral, ethical, social and cultural issues

Throughout the delivery of this qualification learners will have the opportunity to actively participate in different kinds of decision making. They will have to consider fair and unfair situations and explore how to resolve conflict. Working in small groups, they will learn how to respect and value others' beliefs, backgrounds and traditions.

Citizenship

Learners undertaking this qualification will have the opportunity to develop their understanding of citizenship issues.

Environmental issues

Developing a responsible attitude towards the care of the environment is an integral part of this qualification. Learners are encouraged to minimise waste and discuss controversial issues.

European developments

Much of the content of the qualification applies throughout Europe, even though the delivery is in a UK context.

Health and safety considerations

Health and safety is embedded in many of the units in this qualification. Learners will consider their own health and safety at work, how to identify risks and hazards and how to minimise those risks.

Equal opportunities issues

There will be opportunities throughout this qualification to explore different kinds of rights and how these affect both individuals and communities, for example learners will consider their rights at work and the rights of employers and how these rights affect the work community.

Annexe G – BTEC Specialist and Professional qualifications

BTEC qualifications on the NQF	Level	BTEC Specialist and Professional qualifications on the QCF	BTEC qualification suites on the QCF
BTEC Level 7 Advanced Professional qualifications BTEC Advanced Professional Award, Certificate and Diploma	**7**	**BTEC Level 7 Professional qualifications** BTEC Level 7 Award, Certificate, Extended Certificate and Diploma	
BTEC Level 6 Professional qualifications BTEC Professional Award, Certificate and Diploma	**6**	**BTEC Level 6 Professional qualifications** BTEC Level 6 Award, Certificate, Extended Certificate and Diploma	
BTEC Level 5 Professional qualifications BTEC Professional Award, Certificate and Diploma	**5**	**BTEC Level 5 Professional qualifications** BTEC Level 5 Award, Certificate, Extended Certificate and Diploma	**BTEC Level 5 Higher Nationals** BTEC Level 5 HND Diploma
BTEC Level 4 Professional qualifications BTEC Professional Award, Certificate and Diploma	**4**	**BTEC Level 4 Professional qualifications** BTEC Level 4 Award, Certificate, Extended Certificate and Diploma	**BTEC Level 4 Higher Nationals** BTEC Level 4 HNC Diploma
BTEC Level 3 qualifications BTEC Award, Certificate, Extended Certificate and Diploma	**3**	**BTEC Level 3 Specialist qualifications** BTEC Level 3 Award, Certificate, Extended Certificate and Diploma	**BTEC Level 3 Nationals** BTEC Level 3 Certificate, Subsidiary Diploma, Diploma and Extended Diploma

BTEC qualifications on the NQF	Level	BTEC Specialist and Professional qualifications on the QCF	BTEC qualification suites on the QCF
BTEC Level 2 qualifications BTEC Award, Certificate, Extended Certificate and Diploma	**2**	**BTEC Level 2 Specialist qualifications** BTEC Level 2 Award, Certificate, Extended Certificate and Diploma	**BTEC Level 2 Firsts** BTEC Level 2 Certificate, Extended Certificate and Diploma
BTEC Level 1 qualifications BTEC Award, Certificate, Extended Certificate and Diploma	**1**	**BTEC Level 1 Specialist qualifications** BTEC Level 1 Award, Certificate, Extended Certificate and Diploma	**BTEC Level 1 qualifications** BTEC Level 1 Award, Certificate and Diploma (vocational component of Foundation Learning)
	E	**BTEC Entry Level Specialist qualifications** BTEC Entry Level Award, Certificate, Extended Certificate and Diploma	**BTEC Entry Level qualifications (E3)** BTEC Entry Level 3 Award, Certificate and Diploma (vocational component of Foundation Learning)

NQF = National Qualifications Framework

QCF = Qualifications and Credit Framework

For most qualifications on the **NQF**, the accreditation end date is normally 31 August 2010 or 31 December 2010.

For qualifications on the **QCF**, the accreditation start date is usually 1 September 2010 or 1 January 2011.

QCF qualification sizes	
Award	1–12 credits
Certificate	13–36 credits
Diploma	37+ credits

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