

Construction & the Built Environment

The Maths Pipeline: *Supporting maths in post-16 vocational provision*



Resources created as part of
the Maths Pipeline programme.

Developed by Mathematics in Education and Industry (MEI) and
The National Centre for Excellence in the Teaching of Mathematics (NCETM).
Commissioned and funded by the Education and Training Foundation.

Published September 2015

External references

This guide offers links to external websites and resources. At the time of publication all urls provided were correct; however, website addresses may be updated and changed. For each reference, the full name of the publication / resource has been provided to help you deal with any broken links.

Construction & the Built Environment

Contents:

About this guide	1
Why should I be concerned about developing my learners' maths skills?	2
Why use a vocational lesson to develop maths skills?	3
Some teaching ideas	4
Picturing the maths in your vocational area	4
Isometric and Orthographic Projection	5
Other learning activities related to your vocational area	7
Examples of learning activities that you could use or adapt with learners:	
- Tarsia	8
- Sometimes true, always true, never true	8
- Top Trumps	9
Other resources to help learners understand key mathematical ideas	10
What challenges am I likely to face?	11
Engaging learners	11
Some learners may need to improve their confidence with basic maths	11
Difficult topics	12
Working in the Secure Estate	13
Meeting the challenges	14
Working together with maths practitioners	14
Teaching and learning strategies: embedding and contextualising	14
Teaching and learning strategies: developing deep understanding of key mathematical ideas	15
Initial, diagnostic and formative assessment	15
Track learners' mathematical progress alongside their vocational targets	16
How can I develop my own maths knowledge and skills?	16
References	17

About this guide

This guide is one of a series aimed at practitioners from a wide range of providers, including FE colleges, independent learning providers and those working in the Secure Estate, who support post-16 vocational learners to develop their maths skills up to and including level 2.

The guides, together with films which aim to stimulate viewers to reflect on their practice, have been created as part of the [Maths Pipeline Programme](#).

As a vocational teacher you are able to provide a practical learning environment in which learners see a real purpose for developing their maths skills, and you can demonstrate convincingly that strong maths skills underpin vocational professionalism. This guide suggests ways in which you can engage your learners' interest and support them to develop their maths skills.

Throughout the guide you will find sections encouraging you to take a look at other websites, films or educational research documents. These sections are identified using the icons shown below.



For an interesting website



For an interesting document



For an interesting film

The guide is one of five in a series from the Education and Training Foundation (ETF) Maths Pipeline Programme. There are four Guides aimed at vocational teachers working in

1. *Construction and the Built Environment*
2. *Health and Social Care*
3. *Hospitality and Catering*
4. *Hairdressing and Beauty Therapy*

A fifth guide, *Unlocking Maths*, is aimed at specialist maths teachers in the Secure Estate.

The guides are also supported by a collection of films; begin with the [clip](#) that introduces the series and then explore the library of [films](#).

Why should I be concerned about developing my learners' maths skills?

Here are four good reasons:

Developing your learners' maths skills can help them progress in their vocational course

When vocational and maths teachers work together, retention and achievement rates for maths and for the vocational subject improve. See [You Wouldn't Expect a Maths Teacher to Teach Plastering.....](#)

Improving your learners' maths skills increases the employment opportunities open to them.

Maths skills are highly transferable, and improving them will help a learner to become more employable, regardless of whether they stay with their current vocational area.

Maths errors can be costly to any business

Think about the wider consequences if people make mathematical errors whilst working in their chosen area of employment or self-employment. Errors can waste time and resources, can lead to dissatisfied customers, and can undermine health and safety standards.

Enhancing your professionalism

The [Professional Standards](#) (Statement 16) state that as a professional teacher or trainer you should demonstrate commitment to:

"Address the mathematics and English needs of learners and work creatively to overcome individual barriers to learning."

Why use a vocational lesson to develop maths skills?

Many post-16 learners view their previous learning experiences in maths very negatively.

The prior experiences of many vocational learners mean that they may have little or no maths confidence. Making maths relevant with authentic learning activities that link to real work contexts, and highlighting where learners have used maths in your lessons have real benefits. The desire to make progress in their chosen vocation provides considerable motivation for learners to master relevant mathematical skills and concepts. Success and enjoyment in a vocational lesson means their expectations will be high. They may be more willing to persevere with challenging maths and maths that isn't directly relevant to the vocational area but is relevant to a Functional Skills or GCSE qualification they are aiming for.



In this [clip](#) we see how maths can be brought to life for learners by emphasising it in a vocational project. As you are viewing the clip, reflect on the points below.

- Where does maths feature in your project work?
- How can this be brought to life?
- Are there opportunities to work together with a maths specialist to enhance learning in both areas?



In this [clip](#) Lee, a builder, reflects on how mathematics is a part of his everyday work and crucial to being self-employed. (You will need to register with NCETM to view this clip. Registration is free.)



This [clip](#) from BBC Skillswise examines why Maths and English are important in construction.



Here is a short [clip](#) of a civil engineer explaining how volume calculations are required in his role.



This embedding and contextualising approach is underpinned by research:

[You Wouldn't Expect a Maths Teacher to Teach Plastering...](#) NRDC, Nov 2006. .

[Effective Practices in Post-16 Vocational Maths](#), ETF, Dec 2014

[Engaging Learners in GCSE Maths and English](#), NIACE, Jan 2015

[Vocational Training and Employability Skills in Prisons and YOI](#), NIACE, May 2013

[Initial Guidance for users of the professional standards](#), ETF, May 2014

Some teaching ideas

We've introduced a small number of teaching ideas in this section to illustrate approaches which relate maths to your vocational subject and which help learners to understand key mathematical ideas deeply.

Active learning is key; in particular, it can help learners to become aware of and resolve any mathematical misconceptions they may have. Active learning uses strategies such as group work, discussion and open questioning to encourage learners to become reflective, to think mathematically and make links between topics, instead of using memorised techniques or processes. This approach helps students to make connections between their ideas, to understand the interconnected nature of maths and confront common misconceptions and difficulties.

Later sections (see page 11 onwards) describe and respond to some challenges you might face, expand on the principles and research underpinning these teaching approaches, and offer many more teaching ideas.

Picturing the maths in your vocational area

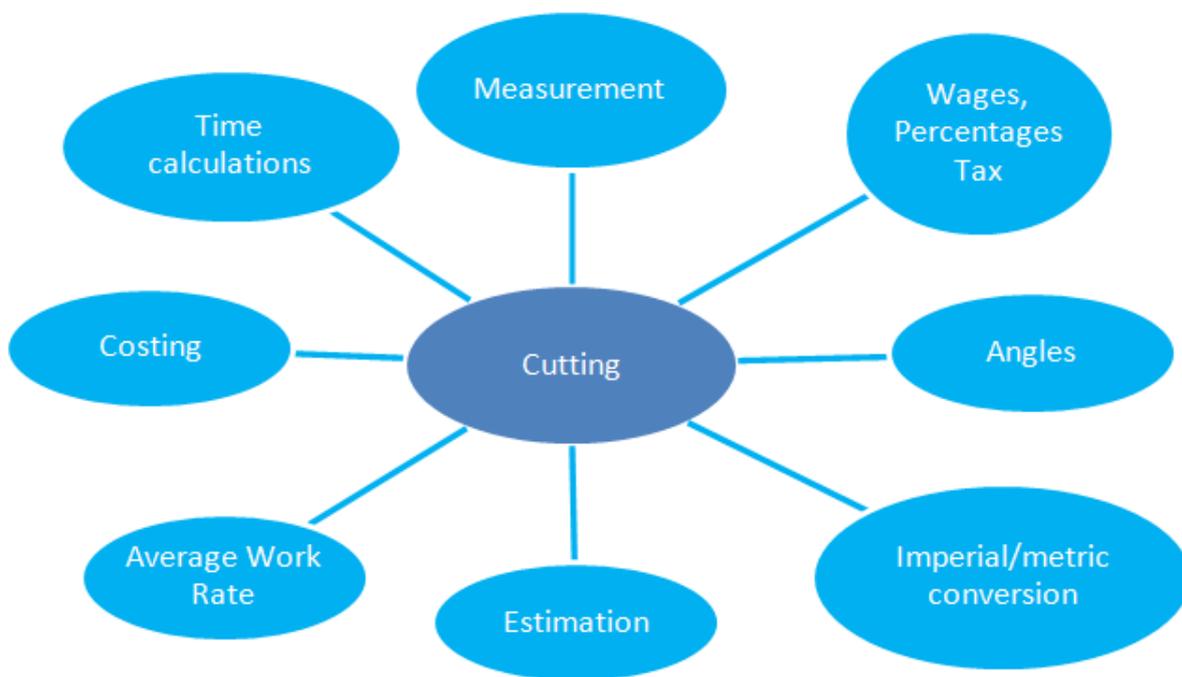
Start with a picture related to construction and the built environment, one which your learners can relate to, and ask them to list some jobs/tasks that spring to mind. Then ask your learners to think about the maths they are likely to encounter when performing those tasks.

Here is one example used at a Vitaliser event, run as part of the [Maths Pipeline Programme](#), for construction practitioners. You could substitute a picture of a plumber, bricklayer, plasterer, decorator, etc

Tasks/Jobs



Maths which underpins one of these tasks: Cutting



You could use the 'Picturing' activity as a starter to a more involved activity for example on planning a project, this could include; estimation, costing, labour rates and times, measurements, reading from plans, etc.

Another idea would be to select a photograph of a practical task the learners will be doing in a lesson you are planning. You could use the picture to discuss with learners what maths they might expect to tackle in the forthcoming lesson, and perhaps identify any mathematical areas they are likely to find difficult. This would then inform your planning and would also help the learners to realise that the maths they will tackle in that lesson is vocationally relevant.

Films would work equally well, or possibly even better, than photographs for this kind of activity.

Isometric and Orthographic Projection

Learners sometimes struggle to represent 3D objects in 2D drawings. You could use this very practical activity to introduce those learners to the basic idea of projection, and to help them understand the crucial role of scale and ratio.

Prepare some 3D shapes made from old boxes. Start the activity by getting the students to draw a plan view of their shape. If they find this a challenge you could suggest they take a picture from above using their mobile phone. If this is not an option, e.g. you are working in the Secure Estate, try building up the activity, starting with one box and then adding the second once your learners feel confidence with the process.

This can be extended to the side, end and other views. The learners will need to use scale and ratio to maintain consistency of dimensions.

A variation of this would be to have different views of a collection of objects which learners are asked to match, or identify. Alternatively, the learners could move on to draw objects using isometric projection.



Other learning activities related to your vocational area



This [applet](#) from the WisWeb site allows learners to practice their skills at reading plans and elevations. Here are some more examples from the same site: [Building Houses](#); [Building Houses with Side Views](#); [Colouring Sides](#). You can view all of the WisWeb applets [here](#). (These links will only work with some internet browsers and you will need Java installed.)



The [Excellence Gateway](#) site has several resources on work-based learning in the trowel occupations, covering areas such: Signs, signals and labels; The building team; Working with drawings; Setting out; and Construction activities. There is an introduction and curriculum coverage document towards the bottom of the page. (Select 'Embedding numeracy in vocational contexts', then 'Vocational' and 'Trowel occupations'.)



The [Excellence Gateway](#) site also has a set of resources on Skills for Construction, covering: The construction industry; Health and Safety; Working Skills for Construction; Using materials and equipment; and Working with others. There is an introduction and curriculum coverage document towards the bottom of the page. (Select 'Embedding numeracy in vocational contexts', then 'Employability' and 'Skills for construction'.)



You can also access these resources from the search facility on the [Excellence Gateway website](#) (Search for 'trowel occupation module', or 'skills for construction module').



Here is a [collection](#) of activities from the national STEM e-library. (You will need to set up a free account to download them). This set of resources, produced by Cre8ate Maths, involves aspects maths in construction. (Register for free with the National STEM Centre in order to download them.)



The [VirtualMaths](#) website provides several interactive activities that shows some of the maths of shapes, space and measurement involved with construction, including: basic structures; levelling surveys; estimating the height of a building; and calculating the volume of a brick.



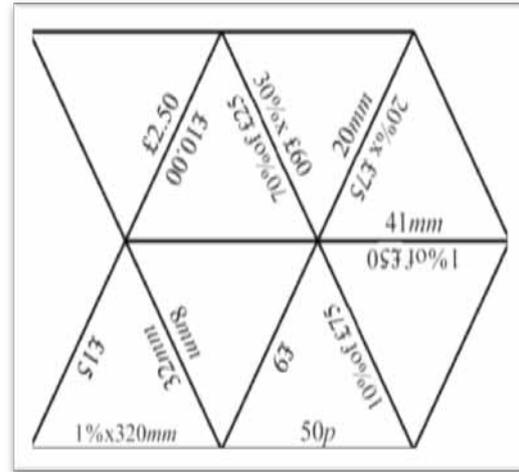
Using vocationally-oriented learning materials helps engage and maintain learners' interest; however, often you will also need to provide support so that learners develop deep understanding of essential mathematical ideas, and develop confidence in their own ability. You could use or adapt the activities below.

Examples of active learning activities that you could use or adapt with learners

Tarsia

Tarsia is free computer software which can be used to quickly produce puzzles like the examples shown below. These puzzles can be used as a lesson starter to get the learners talking about an aspect of maths they are going to encounter in your lesson, to assess your learner's knowledge of the topic and to resolve any misunderstandings or confusions.

300cm	50m	0.5m	3m
250cm	300mm	4000cm	2m
2000mm	50cm	5000cm	Finish
30cm	40m	Start	2.5m



These puzzles use measurement and percentages, both of which are relevant to construction; and you can make similar puzzles of your own using other key concepts.

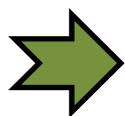
Sometimes true, always true, never true

This kind of activity challenges learners to think deeply about a topic, and also requires them to articulate their thinking. As they are working on the activity, listen to the arguments they are creating, and encourage them to express themselves clearly verbally and on paper; this formative assessment aspect will help identify and resolve any misconceptions.

<i>Sometimes True</i>	<i>Always True</i>	<i>Never True</i>

Add a nought
To multiply by ten, you just add nought on the right-hand end of the number.

The idea is that the learners have a collection of statements which they are asked to sort into three columns. Learners may think that this is always true, but if prompted to think further they will discover that it is not true for decimals. This activity can be adapted to cover a wide range of statements.



The NCETM website section on [Thinking Through Maths](#) contains [collections of statements](#) that can be used for a 'Sometimes true, always true, never true' activity.

Top Trumps

This is an adaptation of the popular card game where players compare data on a collection of themed cards. Learners explore a range of mathematical ideas, e.g. small and large numbers, the use of ratio to create statistics like death rate and birth rate, and how statistics like death rate, population and GDP might / might not correlate; teachers can choose which ideas to emphasise. Group discussion and peer support helps learners identify and resolve any mathematical misconceptions.

In the example below the theme is countries, which learners may see as relevant to their everyday life; however, you could use information with a vocational theme for example, information on power tools, buildings, brickwork patterns, types of joints, mixtures of mortar, concrete, etc.

Australia—Oceania	Sweden—Europe
	
Capital city: Canberra	Capital city: Stockholm
Total population: 21, 766, 711	Total population: 9, 108, 788
Death rate: 6.8/1000	Death rate: 10.21/1000
Birth rate: 12.3/1000	Birth rate: 10.24/1000
Total area: 7, 617, 931 Km ²	Total area: 450, 295 Km ²
Life expectancy: 82	Life expectancy: 81
GDP per Capita: U.S. \$37, 828	GDP per Capita: U.S. \$40, 600

Find a space large enough for all the learners to line up facing you. Give each learner one of the cards. Ask the group to select one of the statistics from the cards, e.g. total population. Now ask the learners to line up in order of total population, from the smallest at one end to the largest at the other end. When they have done this, ask them to read out their population statistic. Get the whole group involved in checking that everyone is in the right place in the line.



Many Top Trump sets are available for free download from the [TES](#) website. (Search for 'Top Trump maths'.)

Other resources to help learners understand key mathematical ideas

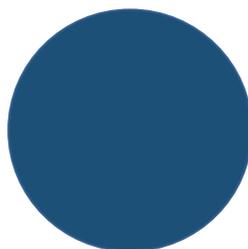


The [WisWeb](#) website has some excellent apps to help learners to explore maths topics including ratio, angles, and other aspects of shape. These are maths apps rather than specific vocational apps.



The [Virtual Maths](#) website provides lots of interactive activities that link maths to real life problems, including number; algebra; shapes, space and measure; and data handling.

The following sections of this Guide describe and respond to some challenges you might face, expand on the principles and research underpinning these teaching approaches, and offer many more teaching ideas.



What challenges am I likely to face?

Incorporating the development of maths skills as part of your vocational teaching is not without its challenges.

Engaging learners

Your learners may feel quite negative about the prospect of continuing to study maths as part of their vocational course, regardless of whether they are also learning maths in separate lessons. Hands-on activities relating to their vocation can help them to see the relevance of maths to their futures, and so can be very effective in engaging and motivating them.



This [clip](#) from the Maths Pipeline Programme, shows construction practitioners teaching the application of Pythagoras' theorem in a workshop setting. As you are viewing the clip, think about a lesson you are about to teach and consider the questions below.

- What maths are the learners likely to encounter?
- How can the maths be made a feature of the lesson?
- What opportunities will this present to teach and assess maths?
- Could you show this clip to learners and discuss with them how maths is used in Construction?



This [clip](#) from BBC Skillswise explains why maths is important in the construction industry.



In this [clip](#) learners are encouraged to develop a sense of number and measurements in a plumbing activity. As you are viewing the clip, consider the questions below.

- Are there opportunities within your sessions to develop the learners' sense of number?
- Which key measurements (e.g. 1 litre of water has a mass of 1 kilogram) are useful to have as reference points in your vocational area?
- Could you use this clip as part of a lesson with your learners?

Some learners may need to improve their confidence with basic maths

One strategy which has been effective in helping with this situation is pairing struggling learners with a maths mentor from the same maths or vocational class: the examples below show how this approach is being used with learners in the Secure Estate.



This [report](#) by NIACE (page 44) explains how at HMP Chelmsford two mentors supported the tutor, resulting in an improvement in the quality of learning and work in the laundry.



The [Maths4Prisons Maths Mentor Handbook](#) describes the Prison 'Maths Mentors' project and includes a link to resources designed for mentors, together with resources which prison staff can use to train 'Maths Mentors'. The primary purpose of the booklets is to support mentors to work with other prisoners on the wing, in maths classrooms or in industrial workshops.

"I feel as though I am good at maths and would like to pass on any help that I can. The guys know who I am and come and see me on the wing."
Mentor at HMP Littlehey.



This peer mentoring scheme is discussed in a [film](#) about teaching and learning in the Secure Estate in England.

When learners help each other, they reinforce their own knowledge and build their confidence; this also allows you to spend more time with the learners who need extra support. Often if these partnerships start in the classroom they are continued outside the classroom, with learners supporting each other outside of lesson time. In the Secure Estate the reverse is often also true; mentors working on the wing often encourage and support other prisoners towards and in the classroom.

Difficult topics

There may be specific mathematical topics which, from experience, you know learners will find difficult. Below are some suggestions of resources to support learners in some of these areas.



This substantial [booklet](#) has lots of examples of maths activities for construction students. It is designed to support vocational practitioners. Some of the calculations are performed using traditional methods; your learners may have different approaches.



This [American site](#) has a number of lesson plans and other helpful information. Most of the measurements are imperial but there are some interesting ideas you may wish to develop.



[Maths4life](#) is a series of booklets providing teaching materials for a variety of topics, including number, time and money, fractions, measurements. (You will need to register with NCETM and set up a free account.)



[Maths Everywhere](#) has some excellent short clips to help learners develop their maths skills. The site has three sections; some tools to help with everyday maths (e.g. currency conversion and planning journeys); a set of 'how to do' short clips; and some interactive questions to try. It is also available as an app.



The [Skills Workshop](#) is a site where practitioners can upload their own resources. It provides a range of lesson ideas covering many aspects of maths and English. The resources can be filtered by vocational area and level. Look out particularly for the resources which use active learning.



The [Excellence Gateway](#) has a large collection of numeracy and vocational learning materials, and the [Maths Exhibition](#) website brings together some of the most effective maths teaching and learning materials from this site.

Working in the Secure Estate

If you are working within the Secure Estate you will have additional challenges such as regime constraints and learners who have additional support needs. The following is an approach taken by one prison:

“At HMP Wakefield, teachers provide contextualised learning within prison industries on a one-to-one basis to help learners who are in the separation unit and/or those who struggle with functional skills or have additional learning needs. This type of support is proven to be less disruptive to the prison day and effective at engaging those furthest away from learning and skills.”

[NIACE](#)



This [clip](#) shows ways in which learning has been embedded in many aspects of prison life at HMP Swalesdale, and this [article](#) discussed how literacy and numeracy have been embedded in the gym there. Similar ideas could work in Construction & the Built Environment.



You might get some further ideas from the report [Fit for Release](#), which discusses ways of helping prisoners prepare for life outside the prison.



This [clip](#) introduces the Offender Teaching and Learning (Vocational Training) Toolkit, and this [clip](#) covers the maths content of the toolkit. Related materials are available on the [Offender Learning Exhibition Site](#).



Meeting the challenges

Working together with maths practitioners

There are benefits to all concerned when vocational and maths practitioners plan work together. Maths specialists can gain an insight into where learners are likely to encounter maths in the world of work, and you get to see how maths is taught to your learners in their maths lessons. You may also be able to get support from the maths specialists in relation to particular maths topics.



Some clips of maths and vocational staff working together are shown in the films which link to this Guide: one from [Hospitality and Catering](#) and one from [Health and Social Care](#).



This report and the associated case studies describe how embedding works, and the benefits it brings. "[You Wouldn't Expect a Maths Teacher to Teach Plastering ...](#)" NRDC, Nov 2006.

Teaching and learning strategies: embedding and contextualising

Some learners may respond better to practical interactive approaches than formal teaching. Try to discuss any maths involved in their vocational tasks; show learners how using maths will help to produce a better solution to a vocational problem, save them work, or avoid errors; and help learners make connections to what they are learning in maths classes.



This [booklet](#) from the USA gives some helpful advice to teachers designing their own maths worksheets using vocational materials. You may wish to change the units to metric.



[This booklet](#) from the Maths4Life series examines topic-based teaching. There is a wealth of good advice about teaching approaches, and assessment.



The [MEI Contextualisation Toolkit](#) provides a range of guides and resources to support practitioners in making greater use of context in their teaching, including developing their own contextualised resources.



The MEI [Maths at Work Guides](#) consists of two documents, one for practitioners and one for employers, which include excellent ideas and advice for integrating maths learning and work experience.



This [clip](#) from the Maths Pipeline Programme shows how a classroom lesson on plumbing can be used to help to develop a sense of number.



Take a look at the [model](#) HMP Oakwood developed for embedding functional skills in vocational teaching and learning.

Teaching and learning strategies: developing deep understanding of key mathematical ideas

One place to start is [Thinking Through Mathematics](#), which emphasises the interconnected nature of maths, and supports teachers and learners to use formative assessment strategies to identify and address common conceptual difficulties. The mathematics dealt with here is roughly Entry Level to Level 2.

A related resource, [Improving Learning in Mathematics](#), offers similar approaches for mathematics from Level 1 to Level 3.

Professor Malcolm Swan of Nottingham University, whose research underpinned both *Improving Learning in Mathematics*, and *Thinking Through Mathematics*, identified eight principles for effective teaching of maths.

Teaching is more effective when it ...

- builds on existing knowledge
- exposes and discusses misconceptions
- uses higher-order questions
- uses cooperative small group work
- encourages reasoning not 'answer getting'
- uses rich, collaborative tasks
- creates connections between topics
- uses technology in appropriate ways



Take a look at [Improving Learning in Mathematics](#) and [Thinking Through Mathematics](#) on the NCETM website for more information about these principles and how you can apply them in your own practice.

Initial, diagnostic and formative assessment

Your learners will learn most effectively when you and they develop insights - through initial and formative assessment approaches - into their needs. Maths specialists often carry out initial and diagnostic assessments before learners join a course, and may be able to share the results with you. You can also use informal self-evaluation questionnaires to help you and your learners understand their needs, and often these can be directly related to a topic they are working on. And most of the resources recommended in this guide have strong elements of formative assessment; for example insights often emerge directly from learner-learner or teacher-learner discussions during active learning activities.



The [Excellence Gateway](#) has a collection of diagnostic assessments covering all levels (search for 'numeracy diagnostic assessment').



The report, [Effective Practices in Post-16 Vocational Maths](#), ETF, Dec 2014 (page 15) discussed current UK practice in diagnosis and assessment.



The document [Approaches to formative and summative assessment of functional skills](#) provides further useful information.



The [Excellence Gateway](#) site has some advice on formative and summative assessment. (Search for 'formative assessment' or 'summative assessment'.)

Track learners' mathematical progress alongside their vocational targets

This will help you and the learners to see where they are progressing and where they need further support. This tracking could also be linked to a positive incentive scheme. Again, this is an area that your maths specialist may be able to support you with.

How can I develop my own maths knowledge and skills?

In parallel with developing your teaching strategies, you may wish to develop your personal maths skills.

A quick internet search may yield a good film or document which helps. Another approach might be to ask a friend or colleague, maybe someone from your maths department if you work in a college. Some clips of staff working together are shown in the films which link to this guide, and have been referenced earlier:

- [YouTube](#): ETF MPP Construction and the Built Environment: Teaching maths in the workshop
- [YouTube](#): ETF MPP Construction and the Built Environment: Bringing maths to life
- [YouTube](#): ETF MPP Construction and the Built Environment: Developing a sense of number

A comprehensive approach to your continuing professional development is to start with an assessment of your needs using this ETF Foundation [maths self-evaluation tool](#). You will need to start by creating a free account. Once this is done, you can find the self-evaluation tool by clicking on Maths and English under the Courses heading. The tool provides a framework for you to self-assess both your personal maths skills and your teaching skills, and signposts you to further support.

Courses

- ▶ Leadership
- ▶ Governance
- ▶ Teaching and learning
- ▼ Maths and English



Mathematics Self-Evaluation Tool

- ▶ New to the sector
- ▶ Equality and diversity

References

External references

This guide offers links to external websites and resources. At the time of publication all urls provided were correct; however, website addresses may be updated and changed. For each reference, the full name of the publication / resource has been provided to help you deal with any broken links.

The references below are split by chapter and section heading.

About this guide

1. The Maths Pipeline <http://www.et-foundation.co.uk/>
2. YouTube video: ETF MPP Supporting maths in post-16 vocational and Secure Sector provision: An introduction <https://youtu.be/EiLhhqE1Rn4>
3. YouTube library: Excellence Gateway films to support post-16 teaching and learning <https://www.youtube.com/user/excellencegateway/>

Why should I be concerned about developing my learners' maths skills?

4. "You wouldn't expect a maths teacher to teach plastering...": Embedding literacy, language and numeracy in post-16 vocational programmes - the impact on learning and achievement (2006) <http://dera.ioe.ac.uk/22311/>
5. Professional Standards: 'Initial Guidance for users of the Professional Standards for Teachers and Trainers in Education and Training – England' <http://www.et-foundation.co.uk/wp-content/uploads/2014/05/ETF-Prof-Standards-Guidance-v2-2.pdf>

Why use a vocational lesson to develop maths skills?

6. YouTube - ETF MPP Construction and the Built Environment: Bringing maths to life <https://youtu.be/wHaR2hSvji4>
7. NCETM film - Maths for Lee, a self-employed construction worker (You will need to register free on the NCETM site.) <https://www.ncetm.org.uk/resources/13932>
8. BBC Skillswise film - Why are maths and English skills useful in construction jobs? <http://www.bbc.co.uk/programmes/p00k3vp6>
9. Education Scotland film - Using maths on building site http://www.educationscotland.gov.uk/video/w/video_tcm4669415.asp
10. See 4
11. ETF: 'Effective Practices in Post-16 Vocational Maths' <http://www.et-foundation.co.uk/supporting/research/effective-practices-post-16-vocational-maths/>
12. NIACE: 'Engaging Learners in GCSE Maths and English' Feb 2015 http://shop.niace.org.uk/media/catalog/product/e/n/engaging_learners_report_1.pdf
13. NIACE: 'Vocational Training and Employability Skills in Prisons and Young Offenders Institutions' Jul 2013 <http://shop.niace.org.uk/training-skills-prisons-yois.html>
14. See 5

Some teaching ideas

Picturing the maths in your vocational area

15. See 1

Other learning activities related to your vocational area

16. WisWeb applets http://www.fisme.uu.nl/toepassing/00198/toepassing_wisweb.en.html
17. From the same WisWeb site, there are more building apps: http://www.fisme.uu.nl/toepassing/00249/toepassing_wisweb.en.html
http://www.fisme.uu.nl/toepassing/02015/toepassing_wisweb.en.html
http://www.fisme.uu.nl/toepassing/00208/toepassing_wisweb.en.html
18. All WisWeb applets http://www.fi.uu.nl/wisweb/applets/mainframe_en.html
19. Excellence Gateway: Work-based Learning <http://maths.excellencegateway.org.uk/workbased-learning>
20. See 20
21. Excellence Gateway home page featuring a search facility <http://www.excellencegateway.org.uk/>

22. National STEM Centre e-Library - Cre8ate collection of building resources (You will need to register free with the site to download resources)

<http://www.nationalstemcentre.org.uk/elibrary/collection/91/building-for-the-future>

23. Virtual Maths website has activities on shapes, space and measure

<http://www.virtualmaths.org/activities/shapes>

Examples of active learning activities that you could use or adapt with learners

Tarsia

24. Tarsia on the Hermitech Laboratory - Information on Formulator Tarisa

<http://www.mmlsoft.com/index.php/products/tarsia>

Sometimes true, always true, never true

25. NCETM interactive resource, 'Thinking Through Mathematics'. You need to register free on the NCETM portal

<https://www.ncetm.org.uk/online-cpd-modules/ttm/contents>

26. NCETM Thinking Through Mathematics - collection of statements You need to register free on the NCETM portal

<https://www.ncetm.org.uk/online-cpd-modules/ttm/teaching-activities/evaluating-mathematical-statements>

Top Trumps

27. TES online teaching resources. Enter 'Top Trump maths' into the search term.

<https://www.tes.co.uk/teaching-resources>

Other resources to help learners understand key mathematical ideas

28. WisWeb applets http://www.fi.uu.nl/wisweb/applets/mainframe_en.html

29. Virtual Maths website <http://www.virtualmaths.org/>

What challenges am I likely to face?

Engaging learners

30. YouTube video - ETF MPP Construction and the Built Environment: Teaching maths in the workshop

<https://youtu.be/gjqJwdqQZy0>

31. BBC Skillswise video - Construction <http://www.bbc.co.uk/skillswise/topic/construction>

32. YouTube video - ETF MPP Construction and the Built Environment: Developing a sense of number

<https://youtu.be/6SmDO4T1OdE>

Some learners may need to improve their confidence with basic maths

33. NIACE report - 'Vocational Training and Employability Skills in Prisons and Young Offenders Institutions' May 2013 (see page 44) http://shop.niace.org.uk/media/catalog/product/v/t/vt_and_es_report_2013_final_1.pdf

34. NIACE - 'Maths4Prisons: Maths Mentor Handbook' <http://shop.niace.org.uk/maths4prisons-handbook.html>

35. YouTube - ETF MPP Teaching Maths in the Secure Sector: Developing peer mentoring in the secure sector

<https://www.youtube.com/watch?v=8ASRdRtHfXk&feature=youtu.be>

Difficult topics

36. Booklet of activities for construction students

<http://www.citbni.org.uk/CITB/files/2b/2b510738-1d32-48f4-b05c-c3bce9467228.pdf>

37. USA Construction Sector Council - 'Developing Trades Math Worksheets'

http://en.copian.ca/library/learning/csc/developing_trades_math_worksheets/developing_trades_math_worksheets.pdf

38. NCETM website - Maths4Life 'Taking the Numeracy Challenge Forward Resources'

https://www.ncetm.org.uk/resources/numeracy_challenge_microsite_resources

39. Maths Everywhere, interactive learning tool <http://www.mathseverywhere.org.uk/>

40. Skills workshop - Free functional skills and skills for life resources

http://www.skillsworkshop.org/contextual?op=or&tid_depth%5B%5D=4

41. See 22

42. Excellence Gateway: Exhibitions website - Raising Standards in Maths <http://maths.excellencegateway.org.uk/>

Working in the Secure Estate

43. See 33

44. YouTube - Embedded Learning at HMP Swaleside

<https://www.youtube.com/watch?v=AbRfDOOf-OA&feature=youtu.be>

45. Prisoners' Education Trust - Teaching in the gym at HMP Swaleside, 15 May 2013
<http://www.prisonerseducation.org.uk/news/teaching-in-the-gym-at-hmp-swaleside>
46. Prisoners' Education Trust - Fit for Release, Aug 2012
https://fbclientprisoners.s3.amazonaws.com/Resources/PET_Fit_for_Release_Report.pdf
47. YouTube - Offender Teaching & Learning Toolkit (Vocational Training)
<https://www.youtube.com/watch?v=2kNpx506-vU>
48. YouTube - Offender Teaching & Learning Toolkit (English, Maths, ESOL & ICT)
<https://www.youtube.com/watch?v=KoCUJ0CSJtI>
49. Excellence Gateway: Exhibitions website - Offender learning <http://offender-learning.excellencegateway.org.uk/>

Meeting the challenges

Working together with maths practitioners

50. YouTube - ETF MPP Hospitality and Catering: Vocational and maths practitioners working together
https://www.youtube.com/watch?v=TQh4_iW9VdE&feature=youtu.be
51. YouTube - ETF MPP Health and Social Care: Embedding maths in Health and Social Care
https://www.youtube.com/watch?v=El_HJ3kNsXo&feature=youtu.be
52. See 4

Teaching and learning strategies: embedding and contextualising

53. American booklet on teaching design
http://en.copian.ca/library/learning/csc/developing_trades_math_worksheets/developing_trades_math_worksheets.pdf
54. NCETM - Maths4Life Topic-based teaching Booklet (You will need to register free on the NCETM website)
<https://www.ncetm.org.uk/resources/8855>
55. MEI Contextualisation Toolkit <http://www.mei.org.uk/contextualisation-toolkit>
56. MEI - Maths at Work, A guide for employers offering work experience as part of 16 to 19 Study Programmes
http://www.mei.org.uk/files/pdf/Maths_at_Work-A_guide_for_employers_offering_work_experience_for_16-19_SPs.pdf
57. YouTube video - ETF MPP Construction and the Built Environment: Developing a sense of number
<https://www.youtube.com/watch?v=f3Kjt6kGCEY&feature=youtu.be>
58. HMP Oakwood Starting with a "clean slate": embedding functional skills in prison work and training - LSIS Case Study
<http://repository.excellencegateway.org.uk/fedora/objects/eg:5398/datastreams/DOC/content>

Teaching and learning strategies: developing deep understanding of key mathematical ideas

59. NCETM - Thinking Through Mathematics: Principles of effective teaching (You will need to register free on the NCETM website)
<https://www.ncetm.org.uk/online-cpd-modules/ttm/principles-for-teaching-mathematics/principles-of-effective-teaching>
60. NCETM - Improving Learning in Mathematics (You will need to register free on the NCETM website)
<https://www.ncetm.org.uk/resources/1442>
61. See 60
62. See 59

Initial, diagnostic and formative assessment

63. See 22
64. See 12
65. Excellence Gateway - Approaches to formative and summative assessment of functional skills
<http://www.excellencegateway.org.uk/content/etf1324>
66. See 22

How can I develop my own maths knowledge and skills?

67. ETF Foundation Online Learning - Self-evaluation tool <http://www.foundationonline.org.uk/>
68. See 30
69. See 32
70. See 57