

Maths at Work

**Integrating work experience and
maths provision in 16 to 19 Study
Programmes (including Traineeships)**

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Summary

About this guide

This guide is for curriculum planners, teachers, trainers and coordinators involved in planning and delivering the maths and/or work experience elements of 16 to 19 Study Programmes.

It aims to encourage the integration of the maths-related aspects of 16 to 19 Study Programmes (including Traineeships) between the classroom or training room and the workplace. It does this in two ways:

- It supports Study Programme providers to engage employers and learners to strengthen learners' mathematical skills during work experience placements.
- It encourages practitioners to use examples of how maths is applied in the workplace to enrich the teaching and learning of maths.

The guide's content is based on examples of best practice from independent training providers, FE colleges, sixth form colleges and schools that have already established this kind of integration. It is hoped this will help to share their experiences with others.

Associated documents

This guide is accompanied by [Maths in Work: A guide for employers offering work experience as part of 16 to 19 Study Programmes \(including Traineeships\)](#), which has been developed to further support you. Although employers are able to access it directly, it will be more effective to introduce them to it when arranging work experience so that you can explain anything they are unsure of.

Putting it into practice

Some of the ideas and suggestions in this document are more relevant to some settings than to others. Your learners will do better if everyone in your organisation involved in maths teaching and work experience approaches these ideas together, agrees which aspects to focus on, and plans how to put them into practice.

Introduction

About Study Programmes (including Traineeships)

All students aged 16 to 19, whether following academic or vocational studies or a mixture, are now expected to follow a Study Programme tailored to where they are in their education and to their career aspirations.

Key features of Study Programmes include:

- Students spend most of their time taking one or more substantial qualifications (the size of an A level or larger), undertaking a Traineeship or doing extended work experience.
- Students who did not achieve grade C GCSE English and Mathematics or better by the age of 16 are expected to continue to work towards that goal.
- Students are involved in an activity that does not lead to a qualification. This often involves work experience, and for those students following vocational pathways work experience is an integral part of their Study Programmes.

Traineeships and Supported Internships Programme are strands of 16 to 19 Study Programmes designed to meet specific learner needs.

Further sources of information about 16 to 19 Study Programmes are listed at the end of this guide.

Why integrate maths?

Integrating the work experience and maths study elements of Study Programmes can be helpful in several ways:

- It improves the degree of fit between the learner's work experience and the study elements of the Study Programme.
- Using mathematical skills on the job builds on these skills and provides the opportunity to practise them in different environments. This may help learners to achieve better outcomes in vocational courses as well as in maths.
- Learning to apply formal learning to the workplace enriches the contribution that work experience makes to the learners' overall development.
- Most importantly, it can help learners to see that maths is relevant to their futures, which may increase their engagement and motivation.

These factors can help learners to enhance their employability skills, improving their chances of securing employment and having a rewarding future.

How can you encourage employers to support this?

Employers are more likely to support these aims if they understand how developing the learners' mathematical skills can benefit them as well as the learner. It is also important to establish what specific input you expect from the employer – and, crucially, for employers to understand clearly what you are offering them in the way of support and guidance, throughout the placement.

General background

Many employers do not know much, if anything, about Study Programmes and the significance of maths in them. It is best to start by making sure that they understand this background.

Employers may also not realise that being functional with maths is not just about doing calculations, but means using maths to help carry out everyday tasks and solve everyday problems. If they understand this they will be better able to highlight examples that are useful to learners.

How can developing mathematical skills help employers?

Employers generally value maths as an important employability skill; however it may be helpful to highlight how improving learners' mathematical skills can bring benefits to the business and help the work experience placement run more smoothly. These include:

- Learners are less likely to make mistakes, which can save time and money.
- They may not require as much supervision.
- It may help them to provide higher standards of customer service.

How can it help learners?

Whilst the needs of their business must come first, most employers also want to help learners to develop. You can encourage employers to take an interest in this by explaining how mathematical skills are important to learners' futures. By helping learners to achieve well in maths they may be opening doors to careers that would not otherwise be accessible.

You can also help employers to appreciate that many learners have low levels of confidence in maths and may feel a sense of failure, so that learning maths becomes more challenging. Developing an understanding of how maths is used in the workplace can help learners to feel maths is less threatening, as well as making it more meaningful to their lives.

Arranging a placement: the maths factor

When assessing the suitability of a work experience placement for a learner you will already take into account whether the learner has the mathematical skills it requires. If you do not already do so, you might also consider how well the work environment is likely to support the further development of these skills.

When discussing the specific educational and training goals of the work experience, ensure the employer is aware of the maths qualification the learner is working towards and what level of maths it involves. If you feel it is appropriate, ask the employer to think about what opportunities they may be able to provide that could be relevant.

You may already negotiate work experience agreements with your employers, such as individual learning plans. If so, you might consider adding specific objectives for the development of mathematical skills. You may also ask the learner to work on a project or carry out work-based assessments. If so, you can also use these opportunities to include the use of maths, involving the employer wherever you can.

Employers may be concerned that these suggestions could be a burden. It may reassure them to know that your learners have been prepared to identify opportunities to develop their mathematical skills themselves, and that you are available to offer your support whenever they need it.

Some employers may also have concerns that some members of their staff may not feel sufficiently confident in maths to help the young person. In this case you may be able to suggest ways in which you can support the process yourself or signpost them to other sources. If you feel it is appropriate, you may wish to offer them training.

Where employers do express any concerns, it is important that they do not feel under any pressure, but instead feel that they can approach you for practical support and advice.

During the placement

Regular review meetings or calls with the learner and the employer provide opportunities to reiterate the importance of strengthening mathematical skills and can be used to ask the learner and employer about progress being made.

Review meetings can also be used to gather examples of ways employers use maths that you can then incorporate in your maths teaching. This can also be a good way of engaging employers, as well as learners, in maths generally.

“We have 2 students who are working in Equipe who regularly have to order new tyres quoting radius, diameter and circumference of the tyres. They also work with tyre pressure. This has been specifically included into their Functional Skills maths sessions covering shape & area.”

Skills Solutions

Supporting employers

Employers may not have much experience of work experience placements and will value your support and advice throughout. This applies as much to the development of mathematical skills as to other aspects of the placement.

The guide for employers that accompanies this guide, [Maths in Work: A guide for employers offering work experience as part of 16 to 19 Study Programmes \(including Traineeships\)](#), expands on some of the points covered above and identifies specific ways that employers can help. Employers are likely to find the employers’ guide particularly helpful before or during discussions about arrangements for a placement. It may also be helpful to recap on some of the content during reviews.

How can you encourage learners to do it?

Learners are more likely to support the process if they understand that practising their mathematical skills will help them both during the work experience and in their future careers. This section provides some suggestions for ways in which you might do this.

In the classroom or training room

Using context in the teaching and learning of maths introduces learners to applications of maths before they encounter them in the workplace. It introduces them to the world of business, and helps them anticipate what work experience may involve.

“To embed mathematical skills we talk about applying maths in the real world. For example, we might talk about painting and decorating. Learners will say that they guess how much paint they need. I can then point out that they are not guessing, they are estimating. A discussion can take place around this topic which is then extended to costs. Working out the area demonstrates costs, wastage and the importance of having a working knowledge of measure shape and space.”

Barnardos

Ways in which contexts may be incorporated are explored in the section below.

Discussions about how the maths relates to work generally can also be encouraging. You might explain that employers value the ability to think logically, perform calculations accurately, and apply maths to solving problems. This helps learners to appreciate the importance of good mathematical skills and instils values that are important to business.

This may also be a good time to include some maths-related career advice. For example, you might discuss which maths qualifications learners will need for the careers they want to follow. Recapping on the significance of maths qualifications to their intended pathway can motivate learners to practise their mathematical skills during their work experience placement, which may help them to achieve better outcomes in all aspects of their Study Programme.

Planning the maths angle for the placement

Before arranging a placement, discuss the mathematical skills required for the role with the learner and help him or her to take responsibility for their learning and progress in these skills. Set clear expectations that learners should take every opportunity to use maths in their work. Encourage them to think about this in advance. Ask questions or use activities to check that they have done so.

When arranging the placement, agree the learner's objectives for practising their mathematical skills. For example, you might set the learner one or more work-related projects to complete during their placement. Some providers, and employers, have standard workbooks, projects or apps that learners can use during their placements. If so, check whether they include maths and if not consider adding it. Think about how you will know whether the objectives have been met. For example, the learner could keep a record of how they have used maths, or seen it used. Remind learners that mathematical skills are not just about calculations but using maths to solve problems.

As the work experience approaches you might also ask the learner to apply their mathematical skills to preparing themselves for it. For example, they could work out travel times in various ways and budget for travel and lunches.

During the placement

Regular review meetings with the learner and the employer provide opportunities to review progress and encourage learners to apply the theory they have learned to the practical situations they encounter in the workplace.

You might suggest that learners record details of projects and progress in a placement workbook, completed alongside their work with the support of the employer. This can then be used to assess learning, and may serve as evidence for some vocational qualifications.

Make a point of asking how they are getting on with their mathematical skills. Ask them to show you examples of what they have done. Discuss any errors in their work and provide support in areas they find difficult, involving a maths teaching specialist if necessary.

Help the learners to recognise how they use maths in their daily routines and duties, where they may not have realised they are doing so, and encourage them to think about what ways they could use maths to improve their work performance.

If a vocational learner is being assessed in the workplace, consider using tasks that involve maths. Advise the work-based assessor or mentor to support the activity and provide the learner with constructive feedback about the maths in particular.

Employers may train learners in how to use technology, such as tills, computers or hand-held terminals. These can help them with the maths in their work; however they need to understand and practise the maths done by the technology so they can see how the technology works and can manage without it if it fails or is not to hand.

There may only be time during work experience to help learners with the specific maths required for that particular job; however you can also encourage learners to take the lead in their own development. This can be supported by signposting resources that can help them practise their skills in their own time. You could also ask them to find out more about wider ways in which maths is used by the employer or that industry in general. For example, they might look at some of the financial aspects of the organisation, or explore the market by comparing data about competitors.

After the placement

When recording the benefits and skills learners have gained from their work experience and feedback from employers, consider which mathematical skills have been practised and how that may have improved learners' confidence and competence.

If you require learners to complete a work experience evaluation, you might consider including questions to explore the extent to which the employer encouraged them to develop their mathematical skills. Amongst other uses, this may help you to provide constructive feedback to the employer and to identify areas to enhance future placements.

If learners return to the study of maths after their work experience, encourage them to reflect on how they used maths during their placement. They can share examples with other learners through discussion, producing a poster, or giving a presentation. If other learners have planned work experience with the same or a similar employer, or for a similar type of work, ask the returning learner to share their experience with them.

Where learners provide feedback on their Study Programmes as a whole, you might consider including questions to explore to how often their maths learning was contextualised and how helpful they found this.

Contextualised maths teaching and learning

Using examples of how maths is used to solve real-world problems introduces learners to applications of maths before they encounter them in the workplace.

Most providers use such contextualisation, finding it helps their learners to see that maths is relevant to many aspects of their lives. It also helps to prepare learners for examinations. Functional Skills Mathematics questions, for example, are based around practical applications of maths and make extensive use of personal and work-related contexts.

Some providers find that contextualisation can help learning to be more effective. It provides a way of visualising a maths problem, or drawing an analogy and this can help learners to make sense of some of the more abstract concepts they meet. This can be particularly important for lower attaining learners, who may only relate to maths if it is contextualised.

“All our lesson plans have a section in them so staff can show where and how they have linked them to other contexts, be that vocational skills or life skills. Learners are encouraged to work out costs when they are visiting places or when they buy food to cook.”

Springboard Trust

Seeing the usefulness of maths can help to overcome any negative associations that may have developed earlier in the learner’s education. Where learners lack confidence, real-life situations can help the subject seem less daunting. It also helps learners to see why it is important to develop these skills. Practical activities that learners can participate in, like planning an outing, can add an element of fun.

Many providers find personal and general work-related examples of how maths is put to use work best with their learners, especially if they are young and inexperienced, as they can connect with them more easily. It helps them to relate maths to their everyday experiences and to situations that they are likely to come across in future. Post-16 learners often find personal finance particularly interesting as it is becoming more relevant to them.

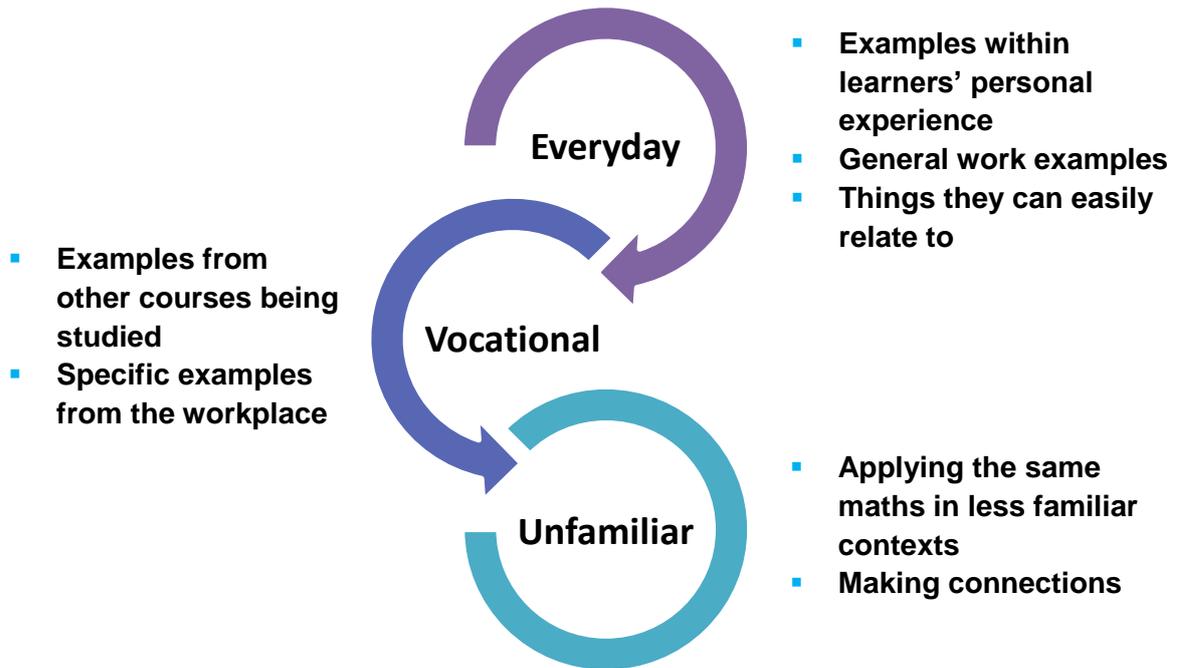
Examples relating to the learners’ career interests can be especially engaging. Specific examples from relevant work-experience employers help to prepare learners for their placement. For vocational learners, the use of vocation-related examples of maths helps develop the breadth of their vocational knowledge; and embedding applications of maths in their vocation study helps strengthen their mathematical skills.

It is, however, important to use a wide range of contexts. Examinations and controlled assessments often require learners to apply their skills in contexts that they may not previously have encountered. Exposure to a wide variety of contexts supports the development of transferable skills, results in a deeper understanding, and provides learners with a bank of experience to draw on.

“Sometimes they only understand a method related to their vocation so in exams do not understand what is being asked of them, e.g. the exam says how many screws are needed for a shelf, childcare learners say they would get someone to do it for them.”

Emma Brailsford

Most providers recommend a gradual progression from familiar contexts to unfamiliar contexts, represented in the diagram below.



Here are some contextualised examples using ratios and proportion that could be introduced gradually as learning progresses:

- **Everyday**
If it takes you 30 minutes to cycle 3 miles to college, how long will it take you to cycle 4 miles to get to your friend's house?
- **General work**
A manufacturer needs to have at least one first aider for every 50 employees. If the company has 127 employees, how many first aiders are needed?
- **Vocational**
Mortar for a garden wall needs to be mixed in the ratio 3 parts sand to 1 part cement. If you use 3 shovel-fulls of cement, how many shovel-fulls of sand do you need?
- **Work experience**
During a work experience placement with Somerton Landscaping, Josh was asked to set out a patio. He needed to use the **3:4:5 method** to make sure the sides would be square. The site was too small to measure in whole metres. What could he do?

- **Unfamiliar**

During the morning shift, a nursing home must have at least one carer for every 5 patients. How many carers are needed to look after 33 patients?

The gear ratio between two cogs is 1:4. If the smaller cog rotates at a speed of 60 rpm, what is the speed of the larger cog?

“We have a student in based at our car body shop in Wigan. They use ratio on a regular basis by thinning two-pack paint with thinners to a precise ratio.”

Skills Solutions

Where learners from different vocational courses are taught maths together, specific work-related contextualisation can still be used but may need more planning. If you have a suitable bank of contexts and resources, you could arrange for learners with similar interests to work together in small groups. You might also encourage learners to identify examples from their vocational courses and use them to introduce others to less familiar contexts.

“During maths lessons we talk about where they will find maths in their work contexts. During vocational learning students are encouraged to identify when maths learning or skills might be taking place - learners are encouraged to record this in their logs and share it with peers.”

Banbury and Bicester College

Examples from everyday life

This section provides a selection of everyday situations where maths is used that could form a basis for contextualised teaching and learning.

Some everyday situations where maths is used	
Personal finance	Budgeting; estimating weekly food costs; bank charges; interest rates
Household bills	Rent and mortgage; utility bills; council tax
Insurance	Costs; comparing policies
Shopping	Comparing deals; discounts; checking change
Cooking	Weighing and measuring; adjusting recipe quantities; planning cooking times; cost per portion
Travel and holidays	Locations; distances; climate; money exchange; timetables; planning how to spent the time

Some everyday situations where maths is used	
Entertainment	Hobbies; interests; planning parties or outings; sharing a pizza or cake
Cars	Buying; comparing features; running costs
DIY	Planning to decorate a room; measuring up and estimating quantities
Gardening and allotments	Garden design; points of compass; planting distances and patterns
Sports and health	Scoring; transfer fees; league tables; fitness measures; BMI; heart rate; weight; healthy eating
Local community	Local economy; charity fund raising activities

Work-related examples

This table below provides a selection of work-related situations where maths is used that may suggest further examples that could be used for contextualisation.

Some work situations where maths is used	
Business and Admin	Designing rotas; time sheets; monitoring staff absences and holidays Use of algebra in spreadsheets Collecting and analysing survey data Pay scales; salaries Average sales; costing services; mark-up and profit margins Running your own business
Construction	Area, volume, perimeter, e.g. calculating materials and costs for bricklaying, decorating, etc. Ratios in mixing mortar or concrete Scaling on plans Angles, height, weight, area and volume used in demolition Shapes and patterns, e.g. in tiling

Some work situations where maths is used

Engineering, Manufacturing and Automotive	<ul style="list-style-type: none"> Gearing ratios Scales on plans Statistics in quality sampling Interpreting designs and drawings
Finance	<ul style="list-style-type: none"> Budgets Accounts
Hair and Beauty	<ul style="list-style-type: none"> Taking money and giving change Scheduling appointment times Ratios in mixing hair dye, etc.
Health and Social Care	<ul style="list-style-type: none"> Measuring temperatures, fluids, etc. Calculating drug dosage Ratios of staff to children and space per child in a day nursery Measuring in baking or making play dough
Hospitality and Catering	<ul style="list-style-type: none"> Booking systems Ratios, measuring and weighing in cooking and mixing drinks Cutting up a wedding cake Taking money and giving change Estimating quantities
Land-based	<ul style="list-style-type: none"> Measuring distances and quantities Ratios e.g. fertilizer mix Trigonometry in surveying
Public Services	<ul style="list-style-type: none"> Planning training exercises Recording evidence, e.g. times, distance, location Navigation
Retail	<ul style="list-style-type: none"> Taking money and giving change Discounts, sales, and reductions Cashing up Stock taking
Sports and Leisure	<ul style="list-style-type: none"> Fitness testing Algebra in body mass index (BMI) Measuring heart rate and weight

“We have a series of work-based learning materials which learners are encouraged to complete. These tasks relate to the learners’ career aspirations.”

GP Strategies Training Limited

Specific examples from employers offering work experience

You may be able to find out about specific uses of maths directly from employers, or from learners who have been placed with them. Here are a few examples:

“Two students work in a pet shop. They help with deliveries, amongst other duties, so we explained that skills would be needed to cross check delivery goods against invoices to ensure accuracy.”

YH Training Services

“Working in our butchers our student is applying the maths he is learning at his training centre on a daily basis. He is tasked with converting the weight of our meats from pounds to Kilograms and is now assisting with pricing.”

Skills Solutions

“We have had learners placed in retail outlets and we research the placements and find out what type of maths they may use, for example a learner was placed at a DIY chain and used measurements and calculations to make a fireplace for a Christmas display.”

Sysco Business Skills Academy

“We have Business Administration students on work placement who regularly use mode, median and range in the analysis of data. They use charts and graphs when working on databases and they regularly use percentages when ordering stationery and office equipment. The students also check and handle deliveries and delivery notes to ensure that what is on the delivery note matches the items ordered.”

Skills Solutions

Further sources of information

Other sources of advice and guidance that could help you include:

- **Post-16 work experience as a part of 16 to19 study programmes: Departmental advice for post-16 education and training providers** This Department for Education document provides further information about the aim and requirements of the work experience element of Study Programmes.

Some sources of maths teaching and learning resources with work-related contexts:

- **Excellence Gateway Embedded Vocational Materials**
- **Maths Careers**
- **Nuffield Foundation Key Mathematical Processes**
- **Nuffield Foundation FSMQ Teaching Resources**
- **National Centre for Excellence in the Teaching of Mathematics Maths in Work resources**

Acknowledgements

MEI is grateful to the Department for Education for providing the support to develop this guide, the Association of Employment and Learning Providers, and the following individuals and organisations who, amongst others, have contributed to its development:

Banbury and Bicester College
Barnardos
Emma Brailsford
GP Strategies Training Limited
Mike Cooper
Skills Solutions
Springboard Trust
Sysco Business Skills Academy
YH Training Services

March 2014

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