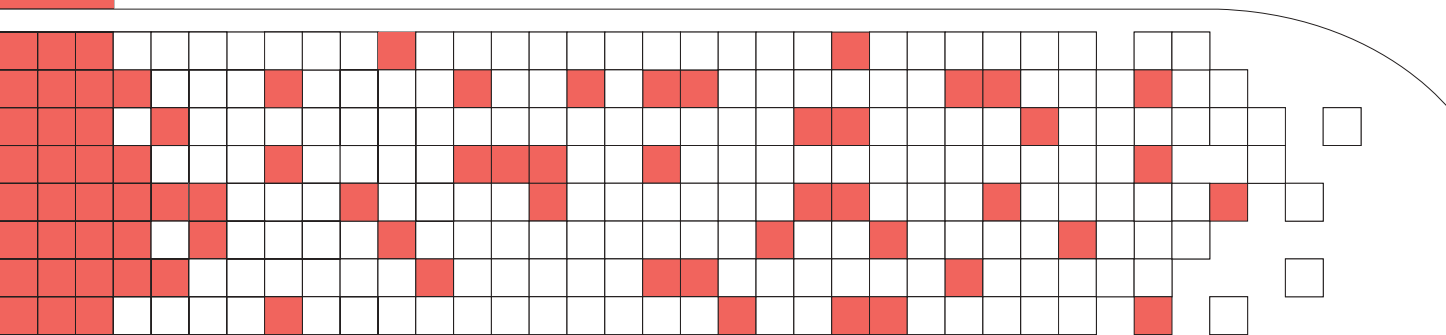


Work-related learning at key stage 4



Mathematics



Qualifications and
Curriculum Authority

Introduction

Work-related learning covers a broad range of activities for students of all ages. These activities help students to learn about the world of work by experiencing and preparing for it. Work-related learning helps students develop knowledge, skills and understanding that will be useful to them.

There is a statutory requirement that all students learn about work and enterprise at key stage 4. This leaflet is designed to help mathematics teachers plan, implement and evaluate successful teaching programmes that support work-related learning.

Using this leaflet

This leaflet may be a useful basis for discussion in department or faculty meetings. When used in conjunction with QCA's *Work-related learning for all at key stage 4: guidance for implementing the statutory requirement*, it can help you decide what your school is required to do and how you can best implement it. You can apply the successful practice that is described, or use it as the basis of a review of current practice.

Teachers should be aware of the contribution that using work-related contexts for mathematics can make to the whole-school provision for work-related learning and wider school aims. They should also be aware of the opportunities to collaborate with other subject departments and faculties on work-related learning activities and projects.

What is the statutory requirement for work-related learning?

The statutory requirement is that schools include work-related learning in the curriculum for all students at key stage 4.

Work-related learning is defined as planned activity that uses the context of work to develop knowledge, skills and understanding useful in work, including learning through the experience of work, learning about work and working practices, and learning the skills for work.

The statutory requirement is for schools to make provision for all students at key stage 4 to:

- learn **through** work, by providing opportunities for students to learn from direct experiences of work (for example, through work experience or part-time jobs)
- learn **about** work, by providing opportunities for students to develop knowledge and understanding of work and enterprise (for example, through vocational courses and careers education)
- learn **for** work by developing skills for enterprise and employability (for example, through problem-solving activities, work simulations and mock interviews).

It is not the knowledge and skills that are unique to work-related learning, but the context in which they are developed. Direct experience of the world of work (through a variety of activities) should be at the heart of work-related learning. All subject areas of the curriculum can help plan and deliver these experiences.

What is the rationale for work-related learning?

Work-related learning is an important part of preparing young people for adulthood and the world of work. It connects learning to earning, and helps young people understand how the economy functions, including the role of business and financial services.

Many of the skills that are essential for both higher education and future employment can be developed through work-related activities. Work experience and enterprise activities, with their focus on social and personal skills, offer opportunities to stretch the most able students. Work-related learning can also offer students opportunities to be creative.

Students are motivated by work-related learning activities. They enjoy having the autonomy to tackle relevant problems, take responsibility for their own actions, engage in real issues and evaluate the outcomes of their decisions. The business world strongly supports the acquisition of business and enterprise attributes as an important factor in developing a skilled workforce and a dynamic economy.

What are the benefits of work-related learning?

Work-related contexts can support teaching and learning in mathematics by bringing realism and application to the course. Business and community enterprises can provide examples of:

- career pathways, qualifications and expertise that people have and how they use them
- key skills, especially planning and problem-solving skills
- 'hidden' mathematics that is used in a wide variety of work situations
- the importance of mathematics in the workplace
- the work practices of individuals and small businesses
- what companies make, who their clients are and what techniques they employ
- how practitioners operate and work in teams
- the constructive use of information and communications technology for the teaching and learning of mathematics
- how an extended mathematical 'tool-kit' can enhance students' employability
- activities that develop attitudes and personal qualities that will raise achievement and motivation.

Framework for work-related learning

QCA has provided a non-statutory framework that describes the minimum provision that schools might make. The framework comprises nine elements, which cover the range of learning opportunities that together can deliver the statutory requirement. It gives the minimum provision for each element and outlines what students should be able to do as a result of their experience. The list of possible learning outcomes is indicative rather than prescriptive. Schools should decide which learning opportunities and outcomes are most appropriate for their students. Subject teachers should decide ways in which they can support any of the nine elements.

Case studies

This section contains case studies to show how mathematics teaching and learning programmes can support work-related learning. They give examples of how the world of work can be used as a resource, environment and context to enhance subject learning. Each case study describes an activity undertaken by mathematics students. In the first six case studies the opportunities relate to work-related learning as described in the QCA framework; in the last four case studies they relate specifically to enterprise education. Most activities will also support careers education and key skills.

Case studies showing how mathematics can support work-related learning

Case study 1: students tackle problems set by business visitors to the school

Work-related learning opportunities:

- undertake tasks and activities set in work contexts
- learn from contact with personnel from different employment sectors
- engage with ideas, challenges and applications from the business world.

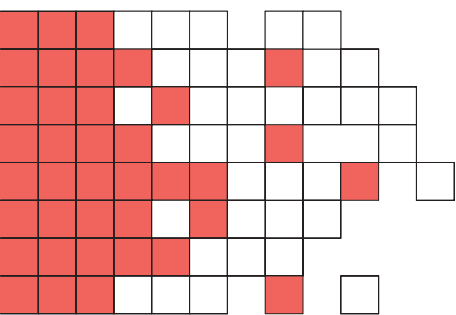
A school organised a 'mathematics and industry' afternoon when representatives from local companies visited the school to run sessions and set problems involving real-world applications of mathematics. For example, an IT manager helped explore the cost-effectiveness of marketing a new computer. This meant creating fields for a spreadsheet, calculating cumulative frequency and interpreting graphical information. A chief mechanic helped students to investigate the relationship between the capacity of an engine and the power it can produce. Students made models of cylinders and calculated their volume and capacity. The event involved students working on real business challenges and learning from business people.

Case study 2: students learn from business mentors about career opportunities

Work-related learning opportunities:

- develop awareness of the extent of diversity of local and national employment opportunities
- learn from contact with personnel from different employment sectors
- engage with ideas, challenges and applications from the business world.

A school had a partnership with a large company that provided an e-mentoring programme for key stage 4 students interested in taking mathematics at A level. Students taking the GCSE higher paper were matched with employees who had taken mathematics as a part of their degrees. The aim was to give students role models who would encourage them to develop their interest in mathematics further and see the application of mathematics in higher-level jobs. As well as advising students on their mathematics work, the e-mentors talked about their own careers and what were the most appropriate higher-education courses for particular careers involving mathematics. The company also organised maths challenge events where students and their mentors worked in teams to solve problems.



Case study 3: students take part in activities devised by a local bank

Work-related learning opportunities:

- learn from contact with personnel from different employment sectors
- have experience (direct or indirect) of working practices and environments
- engage with ideas, challenges and applications from the business world.

A bank developed a series of exercises designed to fit with the GCSE mathematics curriculum and to develop students' financial capability. During an afternoon session a representative from the bank visited the school and worked with the mathematics department to run various exercises. Students researched different mortgage offers to work out the best deals for people and families with different circumstances. In another exercise, students calculated annual percentage rates of interest and compared store and credit card interest rates. Students were involved in work as a context for learning, learning from business people and working on a business challenge.

Case study 4: students collected mathematical data on work experience

Work-related learning opportunities:

- use their experience of work, including work experience, to extend their understanding of work
- undertake tasks and activities set in work contexts
- have experience (direct or indirect) of working practices and environments.

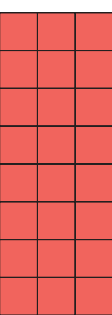
To forge links between work experience placements and GCSE subjects, the mathematics department asked students to develop a questionnaire to collect simple data about their workplace. This included data on the number and gender of employees in each workplace, as well as financial information drawn from published company accounts. They collected examples of the use of number at work, and non-confidential statistics from company documents. This data was collated at school and used for various statistical tasks, including producing histograms and calculating the mean size of each company.

Case study 5: students investigate an assignment on the internet

Work-related learning opportunities:

- recognise, develop and apply their skills for enterprise and employability
- develop awareness of the extent of diversity of local and national employment opportunities
- learn from contact with personnel from different employment sectors.

As part of a cross-curricular project with the careers department, a mathematics teacher asked students to use the internet to research the use of mathematics in different careers. Students used a website called *Maths@Work* (www.mathsatwork.com), which has profiles of people in different, mostly high-level jobs. The students read about the application of mathematics at work and asked individual employees questions via a web forum. The project helped students to develop their awareness of the range of jobs where mathematics is an important aspect of the work.



Case study 6: students meet visitors from the world of work to discuss mathematical ideas

Work-related learning opportunities:

- undertake tasks and activities set in work contexts
- have experience (direct or indirect) of working practices and environments
- engage with ideas, challenges and applications from the business world.

During double periods, a mathematics department used people from the world of work to introduce topics. After speaking about their own career for ten minutes, each visitor explained how they used a particular aspect of mathematics in their jobs. An airline navigation officer described how planes get from A to B using charts he brought with him. The group discussed bearings, scale drawings, triangulation and trigonometry, as well as the use of calibrated instruments for measuring altitude and angle of descent. The following week, a stockbroker discussed the fluctuation in share prices and how they could be tracked over a period of time to detect general trends. Topics discussed included: indices; measures of location (mean, median and mode); percentage changes and formulae used in spreadsheets to show information on price changes.

Case studies showing how mathematics can support enterprise education

Case study 7: students organise and run their own bank

Enterprise education opportunities:

- enterprise capability: organisation; teamwork; personal effectiveness; commitment
- financial capability: money; investment; financial planning; financial decision making; financial transactions
- business and economic understanding: banking; customer care; money market.

A year 10 GCSE mathematics group decided to establish a school bank in their own time. With approval from their head teacher, they researched bank functions on the internet and were visited by a high-street bank education adviser who explained day-to-day operations and what they would have to do to set up the project. Students designed simple cheques and monthly statements for internal issue to depositors. They established a customer care centre to offer advice on personal finance and possible investment. The mathematics teacher monitored all activity, and all cash received was banked in a new school account opened specially for this purpose. All the students had the opportunity to work in the bank, either in customer service or in the activities behind the counter. Students gained knowledge of banking systems and experience of handling money, percentages and calculating balances. Some also learned about the importance of customer service.

Case study 8: students take on the roles of buyers and sellers to develop their mathematics skills

Enterprise education opportunities:

- enterprise capability: organisation; personal effectiveness; key skills; selling; 'can do' approach; ambition
- financial capability: money; costs; risk management; financial planning; budgeting

- business and economic understanding: markets; buying and selling; retailing; business organisation and decision making.

Year 11 mathematics students looked at the mobile-phone market and the role of buyers and sellers and did a roleplay exercise to explore some of the issues. Tariffs and other information from leading suppliers was given to the students in the form of information sheets. Phone companies were set up and 'staffed' by groups of three students who had some training in sales techniques. The remaining students took on the roles of six types of customers, each having their own needs (taxi service, fast-food delivery, young person, and so on). The 'companies' set up their shops in a specific area of the classroom and each was free to decide its own tariffs and special offers. Customers concentrated on the costs and features of the mobile phones and visited the 'shops' to hear presentations and ask questions before deciding which phone to buy. Discussion afterwards looked at key questions about mobile ownership, with a final vote on whether mobiles gave good value for money.

Case study 9: students find out their strengths and weaknesses on personal finance

Enterprise education opportunities:

- enterprise capability: decision making; personal effectiveness; prioritising
- financial capability: financial planning; debt management; budgeting; personal risk management; taking responsibility for own financial affairs
- business and economic understanding: debt industry; business responsibilities; organisation of industry; consumers and consumer spending.

A year 10 mathematics tutor decided to introduce a short course on personal finance. An introductory 'know-how' quiz assessed current financial knowledge of the students and helped to decide future work themes. A set of 30 'I know' cards were designed, each bearing a simple statement such as 'I know how and where to seek advice if I get into debt', or 'I know how to claim the benefits I may be entitled to'. Each student received a set of cards and sorted them into 'I know' and 'I don't know' piles. The students took the cards home so that parents could help them choose what they should learn about first from their 'don't know' list. Groups gave plenary feedback and agreed an order of priority for the work themes. They then had some time for reflection. In this way students became aware of the complexity of financial knowledge and discussed the importance of financial skills.

Case study 10: students invest in national stocks and shares

Enterprise education opportunities:

- enterprise capability: personal effectiveness; team work; organisation; handling data; managing risk; decision making; respect for evidence; leadership
- financial capability: financial planning; budgeting; investment; personal risk management
- business and economic understanding: buying and selling; price; market; stock market; business performance; decision making; interest in financial matters; profit.

A mathematics class decided to take part in a national Shares Portfolio Challenge, in which teams invested in an imaginary £100,000 portfolio in UK and international shares. Students chose their own portfolio of equities and then managed this online over a three-month period, in competition with teams from

other schools nationally. Their teacher introduced associated topics and practical activities on spending and saving, linking this to explanations of the stock market, the process of buying and selling shares, and investment strategies. Share price fluctuations involved graph work: investment risk introduced calculations of percentage gains and losses and the concept of averaging. The investment team showed an overall loss over the period, underlining the concept of risk associated with decision making. The challenge increased students' understanding of investment, business and how the stock market works. Using teamwork the students had investigated important economic principles. The majority stated they had not been put off investing in shares even though they had not done very well first time round.

Further resources and links

QCA has a dedicated *14–19 learning* website at www.qca.org.uk/14-19/. This gives information and guidance on statutory requirements, qualifications and the background to the 14–19 phase, including DfES papers and QCA advice. It has an extensive section on work-related learning.

There are a number of support agencies that help teachers develop work-related learning activities and projects. You can get details of local education-business links organisations from your local Learning and Skills Council or LEA.

The *Vocational learning* website (www.vocationallearning.org.uk) of the Learning and Skills Development Agency (LSDA) includes a range of useful resources, materials, publications and information.

The *Teachernet* website at www.teachernet.gov.uk has information and guidance on enterprise education, a database of case studies and links to further resources and contacts.

Other useful website addresses include:

- DfES *Education business links* (www.dfes.gov.uk/ebnet/)
- DfES *Work-related learning* (www.dfes.gov.uk/qualifications/ – select 'Work-related learning' in 'Site index')
- Ofsted (www.ofsted.gov.uk).

Other publications that you might find useful are *Vocational and work-related learning at key stage 4* (DfES, 2003) and *Work-related learning and the law* (DfES, 2004).

