Learning Mathematics in context

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Aims of the session

This session aims to help subject and vocational teachers to:

- reflect on their own experiences of Mathematics and how this might inform the way they approach teaching the subject with their own learners
- consider how important Mathematics is in their own vocational or subject areas and to identify some of the mathematical skills and knowledge that their learners might require in a workplace setting
- experience an activity that gives a flavour of some of the learner activities in the resource
- experience an activity that models the reflective and collaborative approach to professional development embodied in the Learning Mathematics in context resource.

Time needed

It is suggested that the whole session will take a maximum of two hours. However, the session is divided into five stages, each addressing different aspects of the resource. The times suggested for each stage are approximate, so presenters can use the session flexibly.

Resources needed

- Projector and screen for PowerPoint presentation.
- Flip chart and pens.

For each participant, you will need:

- **Sheet 1: Personal mathematical history**.

For each small group of participants, you will need:

- one set of Mathematics in the workplace photographs
- **Sheet 2: Scales**
- **Card set A: Scale measurements**
- **Card set B: Real measurements**
- flip charts and pens.

Suggested approach

Introduction

Having completed introductions and any 'housekeeping' announcements, show PowerPoint slides 2 and 3, and briefly explain the aims of the session.

Stage 1: Personal mathematical histories (30 minutes)

Introduction (5 minutes)

Explain that it is often useful to spend a few minutes reflecting on our own personal mathematical history. Our own experiences help shape who we are. Our attitudes and approaches to teaching Mathematics have been shaped by our own experiences of learning and teaching the subject.

Individual task (10 minutes)

Hand out a copy of **Sheet 1: Personal mathematical history** to each participant.

Show PowerPoint slide 4.

Ask participants, working alone, to make notes about their own journey through Mathematics. Suggest that this might include:

- courses studied
- qualifications gained
- approaches that their teachers* took to teaching Mathematics and their response to those approaches
- significant events that shaped their mathematical thinking
- times when Mathematics has been really useful in their life
- occasions when they have found some Mathematics hard, or even impossible, and how this was resolved.

We use 'teaching and learning' and 'teacher' as generic terms to include:

- teaching, training and learning
- teachers, tutors, trainers, lecturers and instructors in the further education (FE) system.

Other possible prompts:

- Can you remember an occasion when Mathematics suddenly seemed easy? Was it about a particular topic? What was good about this experience? What did the teacher do to help? Was there a particularly good resource?
- Can you remember an occasion when Mathematics seemed particularly difficult? Was it about a particular topic? What was bad about this experience? What did the teacher do to help? Was there a particularly poor resource?
- Was there one bit of Mathematics that you really enjoyed? Can you explain why?
- When have you used Mathematics in your working life? How was it? Were there things that you found hard? What strategies did you use to overcome them?

Allow about 10 minutes for participants to complete the task.

Working in groups (10 minutes)

Show PowerPoint slide 5.

Ask participants to form groups of between four and six. Ask them to discuss their notes on their personal mathematical histories. In particular, ask them to discuss how their experiences influence the way that they would approach teaching the Mathematics that their learners need to be successful in their own subject or vocational areas.

Ask each group to look for common themes and prepare to feed these back to the whole group in the plenary. Suggest that each group elects a secretary to note the key points of the discussion on a flip chart.

Plenary (5 minutes)

Take one or two points from each group. Sum up the main themes. Encourage positive comments rather than negative, for instance, 'Maths is better when…' rather than 'Maths is boring or difficult when…'.

Aim to highlight, in particular, the following points:

- Active learning in Mathematics works best.
- Relating Mathematics to real life helps some learners.
- Success breeds success.
- Mathematics is multifaceted; each facet calls for a different approach to learning. Mathematics involves:
    a. knowledge; for example, knowing that 7 x 8 = 56
    b. skill; for example, being able to use a protractor, to manipulate equations, to calculate the mean
    c. understanding concepts; for example, the existence of fractions in a variety of forms (the symbol, decimals, percentages, division, etc)
    d. application; for example, knowing what calculation is needed to calculate VAT payable.

Stage 2: An example activity from the resource (30 minutes)

Introduction (10 minutes)

Explain that one of the main aims of the project was to build on the successful strategies and approaches that are embodied in the resource Improving learning in Mathematics and in the Maths4Life resource Thinking through Mathematics.

Explain that these approaches have been used successfully in teaching Mathematics; in this project, Learning Mathematics in context, we have explored their use in vocational contexts. Teachers in the pilot study identified some topics in Mathematics that are essential for their learners but are often difficult to teach and to learn. One example, identified by a number of vocational area teachers, was the use of scale (show PowerPoint

slide [X]). Construction and the built environment and Engineering make extensive use of scale diagrams when drawing plans and blueprints. Scale models are frequently used in Creative and media to 'mock up' a stage set, for example. Society, health and development and Information technology learners are often required to design and plan rooms and workspaces.

Explain that there is a session in the resource designed to help teachers and learners tackle this topic but, to get a flavour of the thinking and the strategies used, we would like you to try one of the activities yourselves.

Explain that this activity comes from a whole teaching session in the resource. The learners will already have discussed some examples of a scale. For example, the teacher might have led the discussion as follows.

- The teacher asks the group what a scale of 1:2 might mean.
- A selection of their responses is noted on the whiteboard.
- This is followed by discussion of how a measurement in real life is represented by a different measurement on a scale diagram.
- The teacher tries a few 'true or false' questions, such as 'A scale of 1:5 implies that 3 cm on the scale drawing represents 15 cm in real life. True or false?'
- The teacher seeks learners' explanations before agreeing or disagreeing with their answer. Learners are encouraged to talk through their thinking.

Working in groups (10 minutes)

Divide participants into groups of two or three.

Give each group a copy of **Sheet 2: Scales**, together with **Card set A: Scale measurements** and **Card set B: Real measurements**. Show PowerPoint slide [X].

Explain that the task is to place the cards onto **Sheet 2: Scales** so that the scales are correct. There are many possible solutions. Encourage participants to take turns to place the cards. For each pair of cards, the participants should explain how they chose that pair. Participants who find the task straightforward should be encouraged to look for more complex solutions.

There are two blank spaces on **Sheet 2: Scales** and some blank cards in each card set. You can encourage participants to invent their own scales, setting additional tasks for their partner to solve.

Plenary (10 minutes)

Ask participants what was good about the activity. Note responses on the flip chart.

There will be many different responses to the question but in particular look for the following.

- It is active.

- There is more than one correct answer to each problem.
- It encourages learners to talk about Mathematics and to use mathematical language.
- Learners can choose numbers that are at the right level for them. Experience shows that learners will usually choose more challenging numbers than their teacher would set them.
- Blank spaces and blank cards create more opportunities for differentiation.
- It offers a range of mathematical challenges, some straightforward and some much trickier, for instance, 3:1 is harder than 2:1.
- The problem can be done either way round – from real to scale or vice versa.
- Learners can make up their own cards and problems.
- It helps to develop mathematical skills that are useful across a range of vocational and subject areas.

Show PowerPoint slide [X].

During this discussion, explain that blank cards are provided so that learners can make cards of their own to complete the task. These also allow a teacher to provide some additional straightforward tasks to support learners who are finding it difficult.

You might also point out that this activity is 'unit free' and so can be applied to millimetres, inches, feet or metres, whatever you feel is appropriate. However, there is a second activity that is much more challenging (for those who need a challenge) and that mixes units, for instance, millimetres, centimetres, metres and kilometres.

Stage 3: Identifying Mathematics in the workplace (15 minutes) (working in groups)

Give a selection of the Mathematics in the workplace photographs to each group.

Show PowerPoint slide [X].

Ask the groups to identify what mathematical skills and knowledge would be important for someone to function effectively in the environment shown. Suggest that the groups elect a secretary to note the key points of the discussion on a flip chart.

Stage 4: The importance of Mathematics (20 minutes) (working in groups)

Show PowerPoint slide [X].

Confirm that we all know that Mathematics is important – in life, in work, everywhere – but many learners cannot (or sometimes will not) see how it is important for them. Ask participants to suggest strategies to help learners see the relevance and importance of Mathematics in their own lives now, and in the future. Suggest that the groups elect a secretary to note the key points of the discussion on a flip chart.

Stage 5: Conclusions (10 minutes)

Plenary

Explain that:

- the reflective activity the participants undertook at Stage 1 of this session is a taster of the approach that the Learning Mathematics in context resource takes to professional development, and that encourages teachers to collaborate, plan together and reflect on the teaching and learning process. Encourage participants to explore this aspect further. This relates particularly to:
    a. the 30 hour requirements
    b. the work of the Institute for Learning
    c. the view that professional development does not have to be all about courses; evidence shows that the best professional development happens when teachers discuss and reflect on their work together.

- the Learning Mathematics in context resource includes a range of sessions that exemplify a whole toolkit of approaches that will be useful in tackling some of the challenges they have been exploring in this session.

Allow about five minutes for summing up and questions.

Sheet 1: Personal mathematical history

This is an individual activity. You will have about 10 minutes to complete the task.

It is often useful to spend a few minutes reflecting on our own personal mathematical history. Our own experiences help shape who we are, and our attitudes and approaches to teaching Mathematics have been shaped by our experiences of learning and teaching the subject.

Make notes about your own journey through Mathematics. You might like to include some or all of the following:

- Courses studied.
- Qualifications gained.
- Approaches that your teachers took to teaching Mathematics and your response to those approaches.
- Significant events that shaped your mathematical thinking.
- Times when Mathematics has been really useful in your life.
- Occasions when you have found some Mathematics hard or even impossible and how this was resolved.

Sheet 1: Scales

Scale measurements	Ratio	Real measurements
	1:2	
	1:3	
	1:5	
	1:10	
	1:20	
	1:30	
	1:50	
	1:100	
	1:500	
	1:1000	

Sheet 2: Scale measurement cards

1	**2**	**2**
2	**3**	**5**
5	**10**	**10**
15	**20**	**30**
40	**45**	**50**
50	**60**	**100**
100	**150**	**150**
200	**200**	**300**
300	**400**	**500**
600	**800**	**1000**
5000	**20000**	**30000**

Sheet 3: Real measurement cards

1	**2**	**2**
2	**3**	**5**
5	**10**	**10**
15	**20**	**30**
40	**45**	**50**
50	**60**	**100**
100	**150**	**150**
200	**200**	**300**
300	**400**	**500**
600	**800**	**1000**
5000	**20000**	**30000**

Sheet 4: Scales

Scale measurements	Ratio	Real measurements
	1:2	
	1:3	
	1:5	
	1:10	
	1:20	
	1:30	
	1:50	
	1:100	
	1:500	
	1:1000	

Sheet 5: Scale measurement cards mixed units

1 mm	**2 mm**	**2 mm**
2 cm	**3 cm**	**5 mm**
5 cm	**10 mm**	**10 cm**
15 mm	**20 mm**	**30 mm**
40 mm	**45 mm**	**50 mm**
50 cm	**60 mm**	**100 mm**
100 cm	**150 cm**	**150 cm**
200 cm	**200 mm**	**300 cm**
300 mm	**400 mm**	**500 m**
600 cm	**600 mm**	**800 cm**
1000 cm	**1000 m**	**1000 mm**

Sheet 6: Real measurement cards mixed units

2 mm	**2 cm**	**2 m**
2 m	**3 cm**	**5 mm**
5 cm	**10 mm**	**10 cm**
15 mm	**20 cm**	**30 cm**
40 cm	**45 cm**	**50 cm**
50 m	**60 cm**	**100 cm**
100 cm	**150 cm**	**150 m**
200 mm	**200 cm**	**300 cm**
300 m	**400 cm**	**500 cm**
600 cm	**800 cm**	**1000 mm**
5000 cm	**20000 m**	**30000 mm**