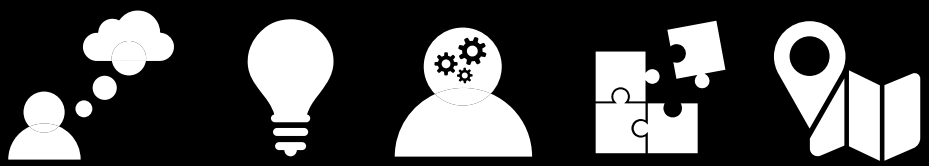
EDUCATION & TRAINING FOUNDATION

CENTRES FOR EXCELLENCE IN MATHS

PRACTICAL APPROACHES TO ENGAGE LEARNERS AND DEVELOP MATHEMATICAL RESILIENCE

AN INTERVENTION FOR FE MATHS PRACTICAL CLASSROOM BOOKLET



Contents

Please scan this QR code to access resources on the Padlet referred to throughout this booklet.

Thank you for doing your bit on behalf of the whole FE maths sector

By doing this intervention you are contributing to the FE Sector's knowledge of what works well in the unique context of FE maths resits as well as improving your learners' experience and progress in FE maths by taking this opportunity to reflect on and develop your own practice.

Summary

This booklet is a practical guide to help plan, prepare and have in your classrooms while trying out a six-week intervention. This intervention was first developed by a group of GCSE maths resit teachers in Further Education colleges in England through action research projects from 2020 to 2022. Then, a larger number of maths resit teachers and learners tried out and evaluated the intervention, to inform the wider FE maths sector and possible future DfE initiatives for FE maths, nationally.

The booklet describes an intervention which may mean introducing something new into your usual teaching practice. Like other teachers who've already tried this intervention, you can integrate it into your existing planning, and make and share adaptations that suit your learners. The intervention is made up of a coherent series of short and focused teaching and learning activities and approaches over a six week period:

Weeks 1 and 6 are when learners' attitudes and performance is measured using questions provided.

Weeks 2 to 5 are a set of short activities and/or approaches to do with your GCSE maths resit learners.

This booklet is one of many resources produced from several years of research and development by FE maths teachers participating in Centres for Excellence in Maths (CfEM). CfEM is a five-year government-funded improvement programme aimed at delivering sustained improvements in maths outcomes for 16- to 19-year-olds, up to Level 2. Discover more CfEM resources and evidence at ETF Maths webpages

Overview of the intervention

The intervention is an approach to motivating, engaging, and developing resilience in FE maths resit learners, as set out in this booklet. By exploring barriers to learning and maths anxiety, the intervention aims to make a shift in the mindsets of the learners so that they show more traits of a growth mindset and feel more confident in the maths classroom. The activities will equip your learners with various strategies that will increase their mathematical resilience. The intervention was designed for 16 to 19 year old maths resit learners and face-to-face delivery.

The following pages summarise what you could do each week. Further training and all the resources are on the padlet accessed via the link on page 2.

Rationale

The introduction of compulsory re-sits for sixteen to nineteen-year-olds who have not yet achieved a grade 4 in mathematics has led to many disengaged, demotivated, and anxious students who struggle to overcome their barriers to learning. Most of these learners become more and more demotivated in ever increasing cycles of continuing 'failure' driven by their own lack of confidence or how they have been labelled previously. Once at this point, it can be difficult for students to find the resilience and motivation to try again… without support. This intervention addresses psychological barriers to learning mathematics, which is key to tackling the low attainment of post-sixteen resit cohorts.

Evidence for the intervention idea

Action research by small groups of FE maths resit teachers who took part in the Centres for Excellence in Maths (CfEM) programme have shown that giving students the strategies and support to identify and address their mathematical mindsets can improve their motivation, engagement, and mathematical resilience.

Findings from the past 2 years of research at Cambridge Regional College and Fareham College have fed into the practical approach described in this booklet so that it can be implemented by a larger number of teachers.

Teacher reflection/notes

In this booklet we have included space for you to write your own personal reflections each week after you have completed the activity. Please review how the activity went with your learners and what they got out of it.

Timeline and support

The research that took place in Autumn 2022 followed the timetable below, though teachers doing this intervention after this date can do it at any suitable time of year.

Autumn term	Half term 1	A. Induction	• Watch this short introductory **Engagement and Resilience intervention video** (Available on the Padlet) • **Planning discussion** a colleague.
		B. Training	• **CPD:** Re/watch Session 1 and join Session 2 (Available on the Padlet)
	Half term 2	C. Intervention	• **Week 1** Baseline measures • **Week 2** Mindsets and 'stuck' • **Week 3** Resilience and mistakes • **Week 4** Growth Zone model • **Week 5** KASH: bringing it all together • **Week 6** Follow-up measures
Spring term	Half term 1	D. Reflection	• **Reflect on what worked well and you'll continue. Share with colleagues. For example, in January.**

If doing the intervention in the Autumn term, your **Week 1** is likely to be the same week as the final November resit exam or the one after that. Ensure you print enough paper maths assessments and questionnaires to give to each of your learners, and the mark scheme – all available on the Padlet. Create unique anonymising codes for the front cover of the assessment and questionnaire only if wanted.

Then, in **Weeks 2 to 5**, you can follow this booklet, using resources including PowerPoint slides and teacher notes downloaded from the Engagement and Resilience Intervention Padlet. There is a weekly reflection box which can be used to record notes on what you did and how it went.

In **Week 6**, the same learners (or as many as possible) complete the follow-up measures, so that results can be compared with the baseline. Again, this must be completed during class time to ensure independence, pastoral support, and high completion rates.

Note: Teachers taking part in the research in Autumn 2022 received an online questionnaire to feedback their experiences and views on the effectiveness of the intervention. This gave invaluable insights into how well the intervention worked and how it could be improved.

Independent researchers published anonymised and aggregated findings in March 2023.

Week 1

Baseline measures: maths assessment and attitudinal questionnaire (50 mins)

Introduction

By now, you'll be aware that there are two baseline measures for all your 16-19 year old maths resit learners and that these are available on the padlet along with all other intervention resources:

1st **a paper-based maths assessment, with approximately 10 GCSE-type questions of varying difficulty on fractions, ratio and proportion.**

2nd **a short questionnaire that mainly focuses on their attitudes to learning maths**

Before starting, plan when in the week to do these baseline measures. Please give learners the maths assessment first, followed by the attitudinal questionnaire second this week. This is because there is a question in the attitudinal questionnaire that asks about their experience of doing the maths assessment. Both baseline measures can be used as learning opportunities.

Note that the same approach to data collection is used in Weeks 1 and 6.

Activity

Inform all learners about the research (10 mins). For example, you could say that you are taking part in some research which involves trying out a new approach in your teaching. You'd really like their help! The aim is to find out how well that approach works so that I know whether I should use it again with other learners in future. Tell your learners that they have the right to opt out of participating in this research at any time and be ready to provide alternative activities just in case.

Baseline maths assessment (30 mins). After informing all your learners about the research, please ask them to complete the maths assessment. Papers are expected to take approximately 30 minutes (there is no strict time limit). Review the scripts by looking for methods and mis-concepts in workings out and skipped questions as well as marks.

Baseline attitudinal questionnaire (10 mins). Download a print-ready version of the questionnaire in advance from the padlet and print a copy for each learner taking part in your intervention. Please distribute a printed copy to all your learners during a maths lesson and explain that this is to find out their thinking about maths (it isn't a test). To re-iterate, the questionnaire should be completed by learners in class, face-to-face with you. This is to motivate and support learners to complete the task, independently. Please do not ask learners to do the questionnaire in their own time or remotely.

Supervise their completion of the questionnaire. Each individual learner should complete their own questionnaire. The questionnaire has approximately 15 questions. It is expected to take 10 minutes but there is no strict time limit. The questions are about the learners' confidence and experience of learning maths, in general. Teachers must not answer questions for learners or suggest answers but can help with question comprehension.

Review your learner data. Review questionnaire results and create a few charts to share with learners at the beginning of Week 2. Please use the mark scheme on the Padlet to mark the maths paper, which can be done at any time before Week 6.

Week 2
Setting the scene: mindsets and 'stuck'

Introduction

It is important to set the scene this week. By exploring mindsets, the learners will start to understand that we need to develop a 'can-do' attitude and a culture in which everyone believes everyone can succeed.

Resources

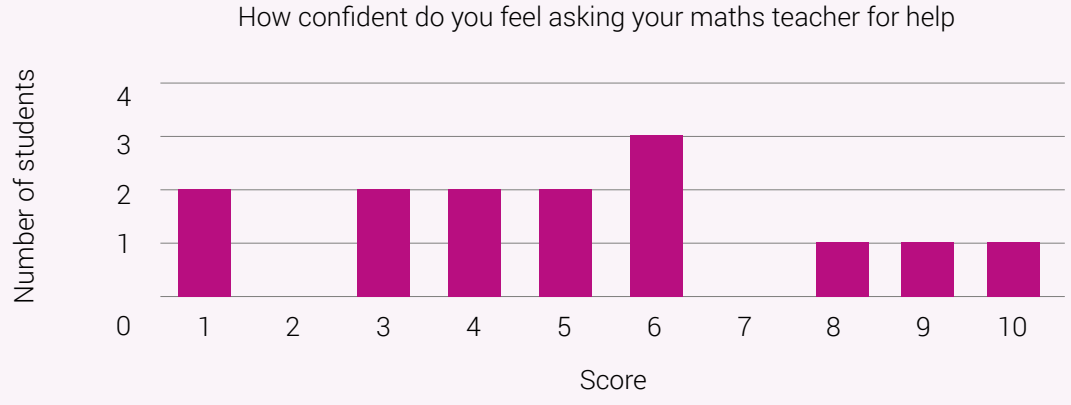
For all resources including teacher guidance including PowerPoint slides, please scan this QR code with your smartphone camera to open the Engagement and Resilience Intervention Padlet.

Activity

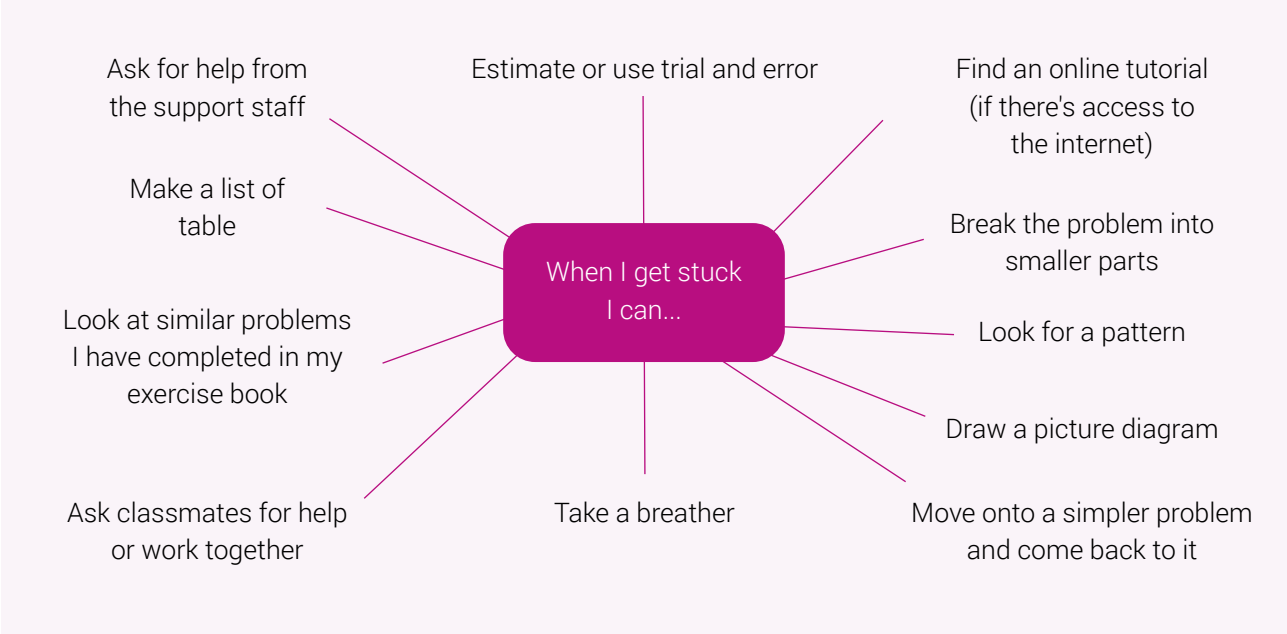
Starter: mindset activity
Give your students the growth and fixed mindset statements provided in the resources. They will need to rate true or false for themselves. They will be asked to categorise the statements into 'fixed' or 'growth'. The aim of his activity is to enable students to identify what it feels like to have a fixed or growth mindset and to understand how they can develop a more growth mindset.

Low stake activity: stuck strategies
First, ask your students to reflect and discuss in pairs or small groups what they can do when they get 'stuck' to become 'unstuck'. Ask them to record their ideas as a group. Teachers can share the example mind map of ideas on the accompanying PowerPoint slides for this week.

Then, you can then display the **data from the pre-intervention survey** with your class to demonstrate that students may have a fixed (or growth) mindset (see image. This will give you the opportunity to discuss the results and highlight responses.



At the end of this activity, you can discuss the ideas that the class have come up with as a group for getting 'unstuck' in their maths classes. See example of ideas collated on flip chart paper:



By the end of this week, your students should be able to:

- ☐ Understand the difference between a growth and fixed mindset
- ☐ Identify strategies to get 'unstuck'

Week 3
Resilience and mistakes

Introduction

To be mathematically resilient a learner must:
• understand the need to STRUGGLE
• understand that MAKING MISTAKES is part of the learning process
• and have RESOURCES available to them to support their learning.
Learners who are mathematical resilient approach maths with agency, persistence and a willingness to discuss, reflect and research.

Resources

For all resources including teacher guidance including PowerPoint slides, please scan this QR code with your smartphone camera to open the Engagement and Resilience Intervention Padlet.

Activity

Starter: what is resilience?
The aim of this week's Starter is to promote discussion on resilience. Watch the 3.23min YouTube video in advance of showing it to your learners. It is intentionally hard-hitting. We selected it because it conveys a strong message about the importance of resilience which we feel will resonate with most learners. Warning: contains strong language that some viewers may find offensive. If you prefer not to use the video, please skip this slide and discuss the still photos on slide 5 instead.

Low stake activity: learning from mistakes
As a class, ask your learners to review a student's work on ratio that shows a mistake due to a common misconception. Ask your learners to identify the mistake and work together to correct it. Use this to lead into a discussion about how the learners feel when they make mistakes themselves.

The learners can then complete a small practical activity involving crumpling up a piece of paper and colouring in the creases. The learners will learn that these crease lines represent synapses firing and brain growth from making a mistake.

The aim of the activity is for the learners to develop an understanding that making mistakes is part of the journey when learning new things.

By the end of this week, your students should be able to:

- ☐ Understand the difference between a growth and fixed mindset
- ☐ Identify strategies to get 'unstuck'

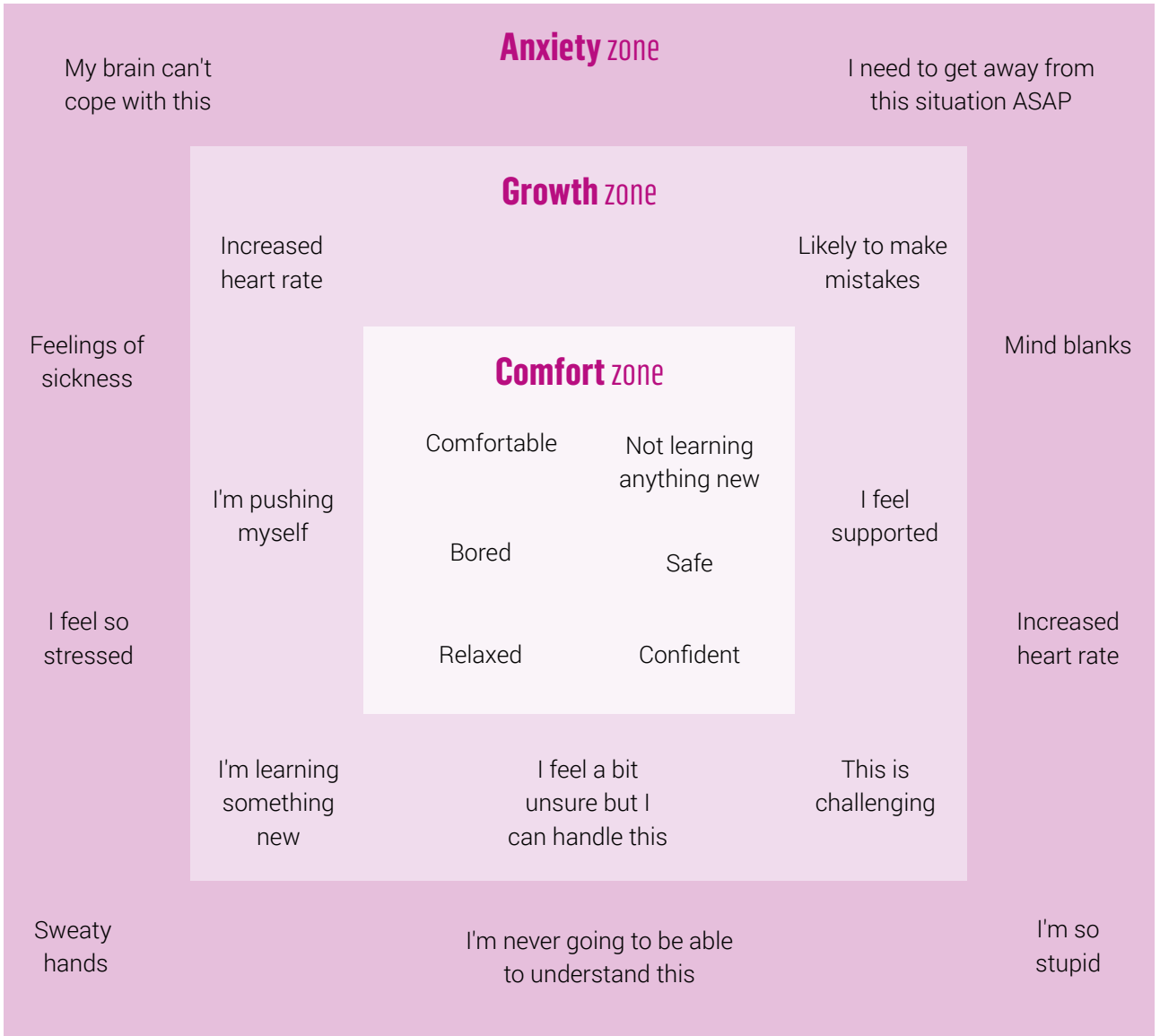
Week 4
Growth Zone model

Introduction

The Growth Zone model (shown here, adapted from Sue Johnston-Wilder) can equip learners to understand the emotional side of learning mathematics. By using the language of the Growth Zone model, teachers can help learners become aware of when the challenge is too much and can help learners with strategies for moving back into the growth or comfort zone.

Resources

For all resources including teacher guidance including PowerPoint slides, please scan this QR code with your smartphone camera to open the Engagement and Resilience Intervention Padlet.



Activity

Starter: how do you feel?

The aim of this Starter is to get your learners to think about how different life situations make them feel. Continue to use the PowerPoint slides to introduce learners to the Growth Zone model.

Low stake activity: the Growth Zone model

In this activity, ask learners to identify how they felt when they were in the red/anxiety zone. This will help them figure out what characteristics they associate with this zone. Learners can then identify how they felt when they were in the green/comfort zone and, finally, the amber zone. Their ideas will enable the teacher to populate a blank growth zone diagram (provided on the Padlet) with key descriptive words in each zone (see example above and in this weeks' PowerPoint presentation). Next, facilitate a class discussion around the relevance of each zone in maths, emphasising the importance of being in the amber zone. The PowerPoint slides will guide you through a discussion of the different zones.

Learners are then asked to complete an activity organising a set of exam-style questions into groups of red (anxiety zone), amber (growth zone) and green (comfort zone) depending on how they feel about tackling each one. They'll then be asked to attempt at least two of the amber growth zone questions.

The aim of this exercise is to show learners how being in the amber/growth zone and tackling questions that are appropriately challenging is key to developing new knowledge and skills in maths.

By the end of this week, your students should be able to:

- ☐ the differences between the comfort, growth and anxiety zone
- ☐ ways to move from anxiety zone to either the growth or comfort zone
- ☐ ways to move from the comfort zone to the growth zone

Week 5

KASH – bringing it all together

Introduction

This session brings the previous weeks of the intervention together by looking at learners' metacognitive knowledge. What does the learner know about how they learn? Thinking about thinking, knowing about knowing, understanding about understanding and learning about learning. What KASH do the learners need to achieve their goals?

Resources

For all resources including teacher guidance including PowerPoint slides, please scan this QR code with your smartphone camera to open the Engagement and Resilience Intervention Padlet.

Activity

Starter activity: Journey to Success
Learners will be asked to identify something that they are good at or have been good at in the past and to note down the steps that they took to get there. The aim of the task is to get learners to recognise the traits needed for success.

Low stake activity: my KASH
The concept of KASH will be introduced so that learners will think about the knowledge, attitudes, skills and habits they need for them to progress in their maths studies. After writing some KASH notes, guided by the PowerPoint, learners will then complete a KASH plan to help prepare them for the upcoming mini assessment (post-intervention assessment).

The aim of the task is to highlight that what works for one learner may not work for another. Learners need to understand what works best for them to ensure that they can achieve their full potential. The task brings together the work done in previous weeks; the need to have a growth mindset, the need to be resilient and an understanding of putting oneself in the growth zone.

By the end of this week, your students should be able to:

- ☐ understand the meaning of the word metacognition
- ☐ understand that everyone thinks and learns differently
- ☐ recognise the unique knowledge, attributes, skills and habits that you need to succeed in your maths mini assessment

Week 6

Follow-on measures: maths assessment and attitudinal questionnaire (50 mins)

In Week 6, please repeat the process that you followed in Week 1 so that all – or as many as possible – of your 16–19-year-old maths learners complete both measures:

1st a paper-based maths assessment, with approximately 10 GCSE-type questions of varying difficulty on fractions, ratio and proportion

2nd a questionnaire that mainly focuses on their attitudes to learning maths.

Once learners have completed the assessment and questionnaire, review your weekly reflections and compare the results from Week 1 and Week 6.

Conclude your research by deciding what to teach particular learners next and what worked well enough to continue or adapt in future and share with colleagues.

Key points:

- In Week 6, please prepare for and administer both measures – the follow-on maths assessment paper (30 minutes) and then the questionnaire (10 minutes). Return to page 5 for details.
- Both measures do not have to be done immediately after each other or in the same lesson, but they do need to be completed in Week 6.
- Compare results from Week 1 and 6, and reflect again on Weeks 2 to 5. Use this evidence to inform your future teaching.

By the end of this week, your students should have completed:

- ☐ Post-intervention questionnaire
- ☐ Maths assessment

Hints and tips

We have included some additional hints and tips on the padlet that are based on CfEM research. We hope that you may find some of the information useful and decide to implement it in your classroom during this intervention.

One last time, please take time to download or bookmark resources - scan the QR code to open the Engagement and Resilience Intervention Padlet.

Teacher reflection/notes

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OUR PARTNERS

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