EDUCATION & TRAINING FOUNDATION

ACTION RESEARCH FOR PROFESSIONAL DEVELOPMENT

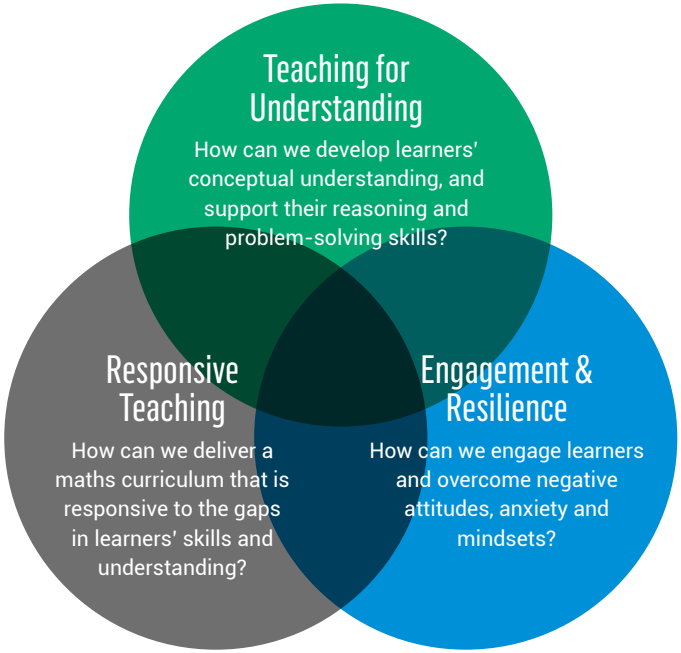
A PRACTICAL GUIDE FOR FE MATHS TEACHERS

This Guide was produced from the experience of five years of action research with 21 networks of further education (FE) maths practitioners across England as part of the DfE-funded Centres for Excellence in Maths (CfEM) programme. Action research groups investigated three areas of mathematics: teaching for understanding, responsive teaching and engagement and resilience. Projects were shaped by five evidence-informed mastery principles. Practitioners did multiple cycles of action research aiming to improve learner experiences and outcomes of maths GCSE resits, contributing to a wider knowledge base of what works and doesn't work in maths teaching across England.

Thank you to the hundreds of FE maths teachers, their action research leaders and centre leads who took part in the action research pathway of the CfEM programme. We welcome your much needed knowledge contribution to the growing field of FE maths education.

Centres for Excellence in Maths (CfEM) is a five-year national improvement programme aimed at delivering sustained improvements in maths outcomes for learners aged 16 to 19 up to Level 2, in general further education (FE) colleges and sixth form colleges in England. CfEM is funded by the Department for Education (DfE) and delivered by the Education and Training Foundation (ETF) and partners.

Teaching for Mastery in FE: Three key questions



FIND OUT MORE

Find out more about the CfEM programme

View the full suite of CfEM action research resources: that's reports, video-presentations and synthesis

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WHO IS THIS GUIDE FOR?

This Guide is for individual and groups of FE maths teachers/trainers/lecturers and support workers within the Further Education and Training sector. It is designed to increase their knowledge and skills in using action research for professional development. It is also for leaders of collaborative action research and leaders of professional development eager to grow cultures of practitioner inquiry and research. Practitioner research requires the full support of managers whether it takes place at individual, team, department, organisational or sector level. This includes manager recognition of action research as a powerful means of professional development as well as logistical support such as coordination, timetabling and remission.

HOW DO I USE THIS GUIDE?

The word 'you' in the Guide addresses multiple audiences. That's individual practitioners, pairs or small groups of teachers researching a maths topic, or a maths department undertaking collaborative action research to introduce or consolidate wider changes for their maths curriculum. The Guide is designed to dip in and out of or read cover to cover. The icons throughout link to further reading, activities and resources (all rooted in the CfEM action research programme). These materials can be used by individual practitioners or in training sessions to support the planning and implementation of action research cycles. Use the Guide flexibly depending on your role, context and purpose.

CHAPTER 1

ACTION RESEARCH FOR FE MATHS: WHY, WHAT AND HOW?

Teaching FE maths resits to 16- to 19-year-olds in England has always been tough, and it's changing again – fast!

Funding is tight, nationally. Staff shortages contribute to stress levels and teachers not receiving planned remission time. Learners aren't doing this course by choice and have previously 'failed'. Many learners bring with them negative attitudes towards maths learning.

At the same time, exciting yet complex shifts are underway in how FE maths teachers teach maths, including adapting and applying mastery approaches in the FE sector. This includes streamlining maths schemes of work; using responsive teaching approaches to address learners' skills gaps and misconceptions; introducing different representations to facilitate conceptual understanding; reasoning and problem solving and the careful introduction of FE-appropriate maths technology.

It is this unique context that makes action research particularly appropriate as teachers work individually or together to figure out systematically what works and doesn't work in FE maths. Managers will need to support such research activity and innovation.

What is action research?

Think of action research as an approach to continuous professional development.

"Action research involves practitioners investigating their own teaching (that's the 'research') and then using what they find out to make improvements (that's the 'action')" (**Doing action research: a guide for post-16 practitioners**, ETF, 2021).

What mindset do I need?

- A desire to learn about your own practice in its complex social context.
- A commitment to improve the FE maths experience for teachers and learners.
- Openness to trying something new, possibly out of your comfort zone.
- A genuine belief that all learners can learn useful maths. Some just haven't had the best opportunity yet.

So, what does this mean in practice?

Action research involves following a systematic process involving reflection, investigation and evaluation to incrementally improve your teaching practice. Many action-researchers use cycles which helpfully break down the research process into a number of practical steps, as outlined on the following page.

In summary, reflect on your teaching and choose one aspect that could be better. Plan an intervention, informed by others. Try it out multiple times and evaluate. Put what you've learned into practice, share findings with others and start over with a new focus. You don't need to follow the cycle rigidly but you do need to follow a process so your findings can be scrutinised and used by the wider maths community.

By doing action research, you'll meet almost all the **Professional Standards** for teachers and trainers in the FE and Training sector.

VIDEO

Watch John Spencer's description of action research. [2 mins: 24 secs]

QUOTE

"Action research is meaningful, motivating, manageable"

Francis Gilbert, Goldsmiths, University of London

ACTIVITY

Consider '**What is action research?**' using this 30 minute activity, individually or with colleagues.

Using action research cycles

Action research cycles provide a high-level structure, breaking down research into practical steps, making it easier to schedule. A single cycle may take half a term to a term to complete or longer. Teachers tend to do multiple cycles over several years.

There are lots of versions of action research cycles. Here's what FE maths teachers who took part in the DfE funded CfEM programme (2018-2023) found worked. After three years, with internal and external support, these FE maths teachers were sufficiently confident and skilled to continue doing action research for their professional development.

Self-observe: What's actually happening?

Reflect: Which parts of my practice could be better?

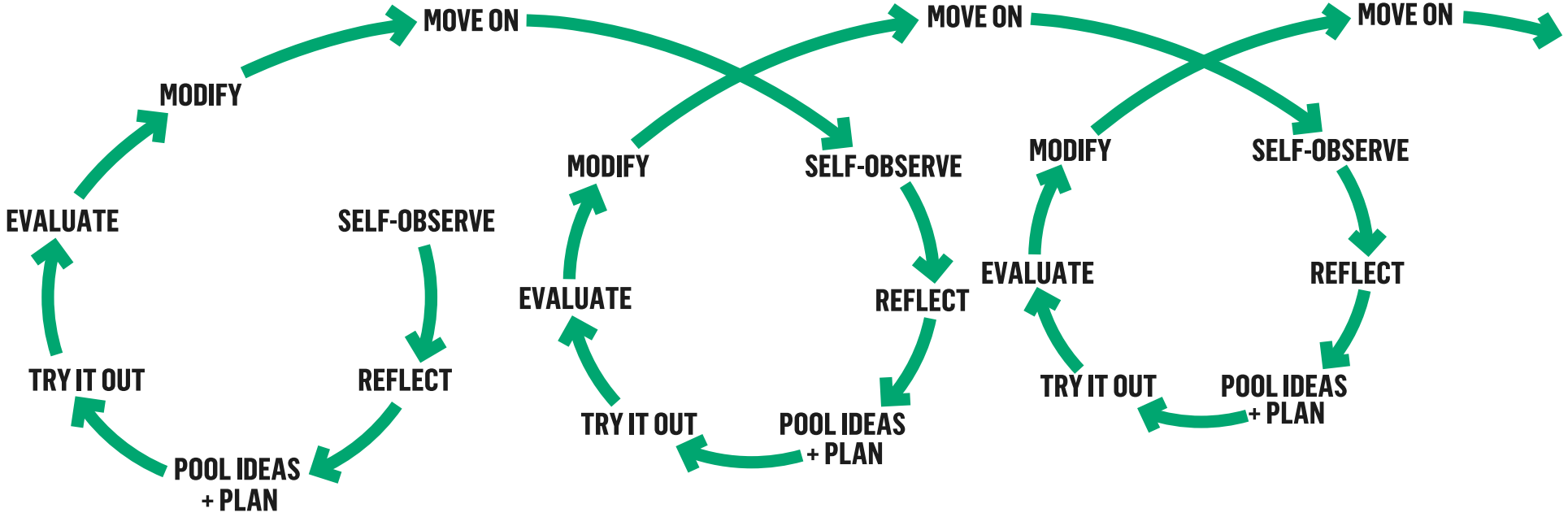
Pool ideas and plan: What could I do that is a little different?

Try it out: Try out your plan or 'intervention' again and again, adapting it as needed.

Evaluate: Collect and process data to get a rounded picture of what works for whom, what doesn't, and why?

Modify: Make changes to your practice based on what you've found out.

Model of action research cycles used by FE Maths teachers



CHAPTER 1

ACTION RESEARCH FOR FE MATHS: WHY, WHAT AND HOW?

The FE maths teachers who participated in the CfEM programme found it useful to think of their first action research cycle as **exploratory** (to understand their topic better), the second cycle as really **developing** their practice and the third cycle as **refining** their new practice.

CYCLE 1: EXPLORE

CYCLE 1: Understanding your topic or problem better than you currently do.

Explore what's happening and why with an open mind. Consider using qualitative and quantitative methods and be clear whether you're measuring behaviours, attitudes/mindset, achievement/progress, mathematical understanding or something else. Perhaps do cycle 1 in half a term when there are no exam sittings.

Start with individual self-observation and reflection. Next, gather wider perspectives by pooling ideas from yourself, learners, colleagues and literature. Inform learners and colleagues that you're doing some research and would welcome their help. Ask for their views and experiences.

Do some reading to extend your current knowledge and help plan your intervention. Immediate feedback and reading could lead to 'penny drop moments' or 'quick wins.'

CYCLE 2: DEVELOP

CYCLE 2: Developing further your knowledge and skills.

Start by re-writing a clearer research question or title, reflecting on your current practice and finding out what others with expertise say about your particular area of FE maths.

You may decide to spend a term on this cycle. The middle six weeks will be trying out your intervention, evaluating and making small modifications to your practice on the go.

Remember to keep your eyes on the ultimate prize – ongoing incremental improvements in the experiences and/or progress of FE maths learners.

Adding greater detail and/or involving additonal participants will give more robust findings.

When forming conclusions, say what you'll continue to implement and what's still not working for whom. Celebrate and share your research with others.

CYCLE 3: REFINE

CYCLE 3: Refining your practice so your previous intervention, or a new one, works well for everyone and/or extends to encompass related or wider issues.

You may decide to do, for example: case studies of individual learners for whom cycle 2 didn't work; adaptations for learners on different vocational programmes; address barriers to learning; add in new modes of delivery including online… the possibilities are endless.

Plan to spend around half a term on this cycle, with the aim of becoming more fully confident and competent.

By the end of three cycles of action research, you'll probably be expert in quite a niche area of FE maths so share your findings and professional development experience widely.

This **resource** has many practical suggestions to aid the planning of your action research cycles including suggested timelines.

CHAPTER 2

CHOOSING A RESEARCH TOPIC

In action research, self-observing and reflecting on your own practice are important first steps in the process of choosing what to research. It's the starting point for all action research cycles. As an education professional, you'll be familiar with reflective practice and there's a huge amount published on the subject.

However, it may help if you ask yourself a few questions.

- What went well in my recent lessons?
- What in my lessons didn't go as well as I wanted?
- What would I enjoy doing more of/happening more often in my teaching?
- What as a maths team is our most pressing challenge right now?
- What does assessment data tell us about the progress and skills gaps of learners across the department?

What will you research?

Choose a research topic that you're genuinely interested in, that you believe matters and that you and your colleagues have the power to change. The topic has to be researchable, so not too big and readily studied through asking questions, reading, reviewing work and collecting data.

Think of choosing a research topic as a process. Move from reflecting on your own practice to identifying the broader influences on your work (known as wider contexts). You'll need to narrow down your focus either individually or as a research group to formulate a specific research question or title.

What influences your work?

These are the wider contexts of your research. Make notes to help you focus on what's important in your work and why. Consider why FE learners struggle to learn maths. Take on board the experiences and views of your maths learners, colleagues and your research team. It adds credibility and impact if you can justify and provide a clear rationale for your topic selection.

RESOURCE

Download this **page** to make notes related to each of the four contexts.

Review national policy including the Condition of Funding, your organisation's previous examination results, Quality Improvement Plan and Self-Assessment.

Choose something you (and your research team) are genuinely interested in and would like to improve. It should sustain professional curiosity for the length of an action research cycle.

Your area of teaching could be related to maths curriculum, pedagogy, behaviour, technology for learning, assessment or educational psychology.

Access and browse ideas from FE maths experts, for example:

- CfEM resources and evidence (ETF)
- Mathematics Education Innovation (MEI)
- National Centre for Excellence in the Teaching of Maths (NCETM)
- Improving Learning in Mathematics (DfES)
- Centres for Excellence in Maths action research, summarised in Changing the Experience of FE Maths (2020-2021) plus 69 CfEM reports and videos-presentations.

Focus on the needs of your learners. Consider the following questions.

- How would I/we describe the learners? For example, socio-economic background, attitudes to maths, previous grades etc.
- Are there specific groups of learners that may benefit from a new approach, or do you want every learner you teach to be involved?
- What are diagnostic assessments and other learner data telling you?

Narrowing down your research focus

It's time to narrow your research focus into something that will impact on your practice, is achievable and measurable. Here are three recommendations from experienced FE maths action research leaders on how to establish a precise focus, ready for your first action research cycle.

1. Read up on your broad research topic

What credible sources of information can you find online and what do they recommend? If researching with others, one person could identify 3-5 short articles or extracts for everyone to read and share followed by a discussion. See section four for inspiration on credible sources.

2. Listen to the views and practices of others

Ask colleagues and learners for their views and experiences. You might be surprised by what they suggest or share! This isn't rigorous research but may well steer your research in a particular direction.

3. If researching with others…

Either all agree which one thing to investigate first or that you'll each investigate different aspects of the same broad topic.

ACTIVITY

Developing your research focus

Read the **three examples** of teachers' initial thinking about what they should research.

Complete the fourth row with your ideas. ☑

	Summary of initial self-observation and reflection	Which bit of your practice could be better?	Who will you focus on? (a balance of who'd benefit from your intervention and what's manageable for you)	What change do you want to see?
Teacher 1	Learners find ratio a particularly tricky topic.	Teaching learners alternative 'ways in' to doing ratio via pictorial representations in form of bar charts.	GCSE maths learners who don't already have a secure method for ratio questions.	These learners show better understanding of the concept of ratio. They can successfully use ratio tables to gain more marks on relevant exam-type questions.
Teacher 2	Only a minority of students verbally feedback what they don't understand in class. Fundamental mathematical misconceptions are being missed and so aren't addressed. Learner data shows these learners get the questions on the same topic wrong repeatedly.	Focus on identification of mathematical misconceptions (e.g. through diagnostic questions) so precious teaching time is spent filling skills gaps. Address misconceptions which emerge through active participation by all learners.	Classes with the quietest learners who previously achieved lower grades in GCSE maths. For me/us, that's 4 classes.	Learners discussing misconceptions. Increases in learner-teacher interactivity in general. Specifically, individual improvement in performance on maths topics where misconceptions were identified and addressed.
Teacher 3	Learners missing out on valuable marks by not having the confidence to attempt, and the skills to break down, worded problem-solving (AO3) questions into achievable steps.	Sharing strategies with learners for: (i) maintaining a positive mindset; (ii) breaking down common types of 4-mark questions; (iii) using diagrams & visual representations.	Initial input on strategies to all my/our learners. Then, additional intervention with one small group who typically skip AO3 questions per class.	More learners willing to attempt AO3 questions. Learners gaining more marks in AO3 questions. Learners who previously skipped 4-mark questions showing understanding of psychological and skills-based strategies for attempting them.
Now have a go at populating the next row using your own example.				
Your example				

ACTIVITY

DRAFT YOUR RESEARCH QUESTION OR TITLE

Draft an initial succinct research question or title. This may change as you start researching.

Include the broad area for improvement, who it is for and the type of solution. If it helps, fill in the blanks in one of the sentences and study the examples.

Sentence 1:

To [**desired outcome**] for/of [**who**] by [**change you want to see**] by [**specific intervention**]

Example: To [improve progress] for [grade 3 learners] by [deepening understandings of ratio] by [using pictorial representations].

Sentence 2:

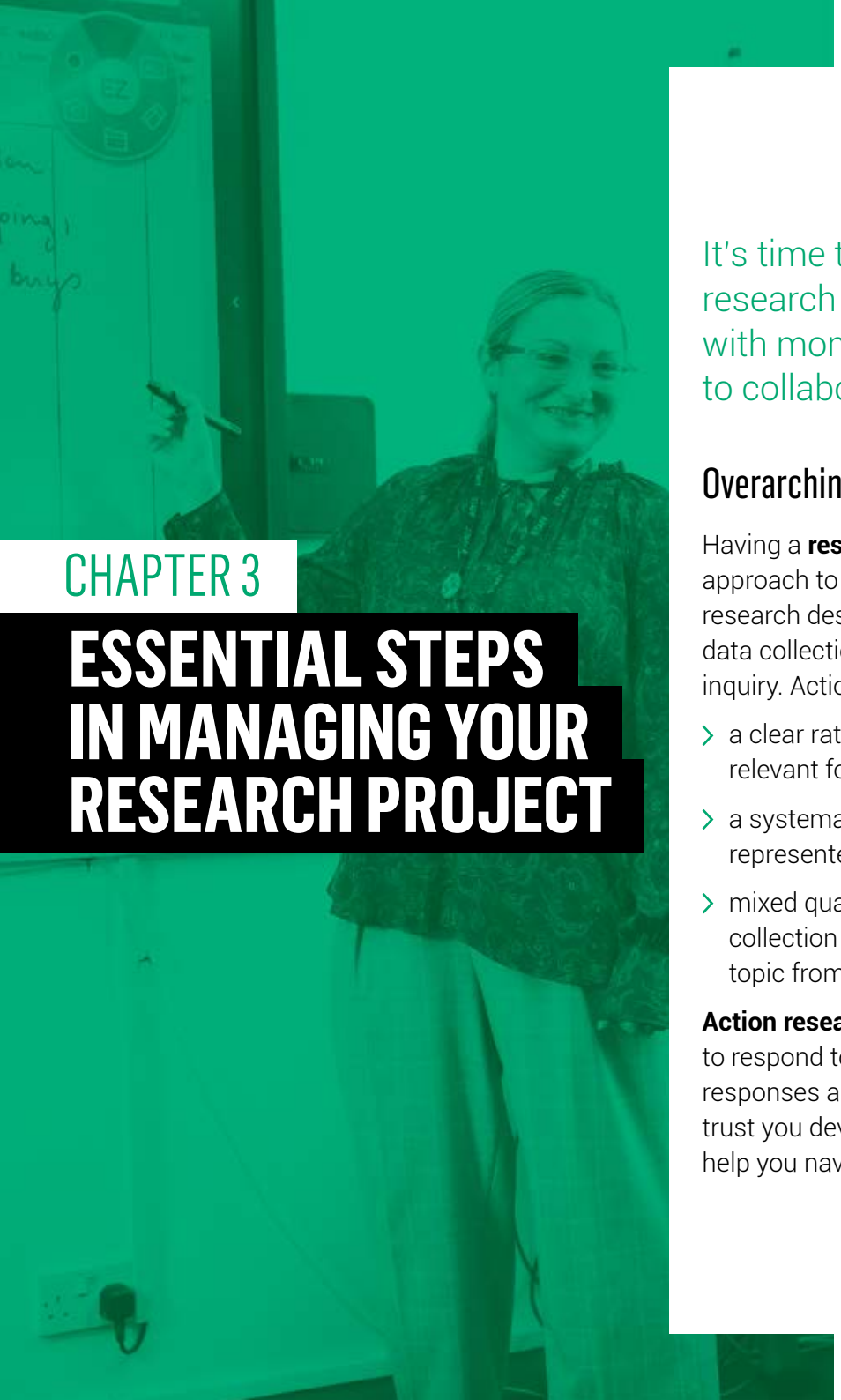
What [**area of practice that could be better**] helps [**who**] to [**the change you want to see**]?

Example: What [approach to diagnostic assessments] helps [disengaged and de-motivated FE maths learners] to [address their skills gaps]?

Sentence 3:

How can [**specific intervention**] for [**who**] to [**desired outcome**]?

Example: How can [an intervention focusing on key words and phrases specific for GCSE maths] help [learners with English as a Second Language] to [increase their participation in lessons?]



CHAPTER 3

ESSENTIAL STEPS IN MANAGING YOUR RESEARCH PROJECT

It's time to turn your attention to planning and managing your action research project. Investing time in the following four steps now will help you with momentum and direction: overarching research design; your approach to collaboration; ethical conduct and writing a project timetable.

Overarching research design

Having a **research design** means articulating your approach to the research at a high level. A good research design will guide you towards choosing data collection methods appropriate for your inquiry. Action research projects typically have:

- a clear rationale and purpose for a highly relevant focus and solutions;
- a systematic and iterative process, usually represented by an action research cycle; and
- mixed qualitative and quantitative data collection methods to examine your research topic from a variety of perspectives.

Action research is messy, but it does enable you to respond to evolving priorities and participants' responses as they arise. The relationships and trust you develop with learners and colleagues will help you navigate the bumps.

Keep reminding yourself that action research is an iterative process – you'll engage in a process of continuous improvement by applying what you've learned, often in real time, and use your new knowledge to inform next steps.

Your approach to collaboration

Collaboration makes research enjoyable and productive. It takes many forms and is a skill that can be learned through planning and experience.

Many unfunded teacher-researchers start off as **individuals** but after a few action research cycles it's worth **pairing up with another teacher** with common interests. Identify a **senior staff member** to input ideas, possibly act as an advocate or mentor and to report to. There may be opportunities to work **collaboratively**, for example a maths team or across departments or even organisations, but this will require substantial manager buy-in and logistical support.

For a broader perspective, consider attending a practitioner networking session with like-minded professionals from beyond your own organisation – try the Learning and Skills Research Network or the Society for Education and Training's Practitioner Research Special Interest Group.

Collaboration takes time and effort, but there are huge benefits.

- Improving quality of teaching through dialogue, debate and sharing of ideas;
- Developing a research culture in your department/organisation;
- Building a larger and more robust evidence-base; and
- Happiness at work through ownership of professional development and revitalising social contact.

Collaboration also involves technical skills of managing yourself, research participants and others who have an interest in your work through a logical sequence of research-related activities. It will involve awareness of and careful negotiations around power relationships at work.

Ethical conduct

All researchers have a duty to conduct their research ethically.

Ethics are concerned with the way people act or behave. One aspect of research ethics is GDPR; the legal rights of the individual concerning the data they provide and guidelines for the collection and processing of personal data.

Guidelines for ethical conduct

Informed consent: All participants should be informed about the nature and purpose of the research and give their consent to take part. Information should not deceive the participants in any way, and they should not be pressurised into doing anything against their will.

Fairness and respectfulness: All participants should be treated fairly and with respect. The researcher should not withhold benefits from some participants, impose disadvantages or unfairly favour some.

Limited imposition: The researcher should avoid taking up too much time or invading privacy.

Confidentiality and anonymity: Efforts need to be made to maintain confidentiality and anonymity.

Adapted from Wellington, J. (2000). Educational research: Contemporary issues and practical approaches. London: Continuum International.

RESOURCE

BERA (2018) **Ethical Guidelines for Educational Research.**

Ethical consent form (CfEM)

ACTIVITY

Consider ethics from a learner's perspective. Discuss the questions on the accompanying **resource**.

A learner's perspective

Tell me about your research.

Tell me why are you're doing it?

Whose involved?

What's my role?

Please treat me with respect.

What will you do with what I say?

Ask me if I want to participate and make it a genuine choice.

Ask questions that are relevant to me and show you are really listening.

Share my story in a way that's fair and considerate.

Adapted from Johnson, K. (2000). Research ethics and children. Curriculum Perspectives. 20. 6-7.

Writing a research timetable

Drafting a research timetable is good practice. Use some or all of the tips and resources to make it easier to write.

Teachers new to action research often wonder what it feels like to do research and what's involved. Having an idea of the whole research process, end-to-end, helps. This is particularly so in collaborative action research. Access the **handout** to review four different ways of thinking about your whole action research project.

When doing action research, it's common to hit obstacles. Here are some typical pitfalls that teacher-researchers encounter.

QUOTE

"Think about the specific outcome and what it is you are trying to achieve, and work backwards. This will drive initial research questions and data collection and analysis methods."

FE maths teacher

Common pitfall	Implications for action research
Felt I lacked authority to engage a senior 'influencer' early on	Colleagues disregard findings
I didn't involve learners from the very beginning	Insufficient data
Data processing took way longer than imagined	Simplistic findings
Reading led to more questions than answers	Unactionable recommendations

Getting started with writing your research timetable.

Decide an end date for your next action research cycle.

Allocate roughly equal amounts of time for:

(a) set-up;

(b) trying out your intervention and collecting data; and

(c) analysis and dissemination.

Many projects leave too little time for (c), to have impact.

Working backwards from your end date, populate your timetable with research activities and who'll action each activity plus dates.

RESOURCE

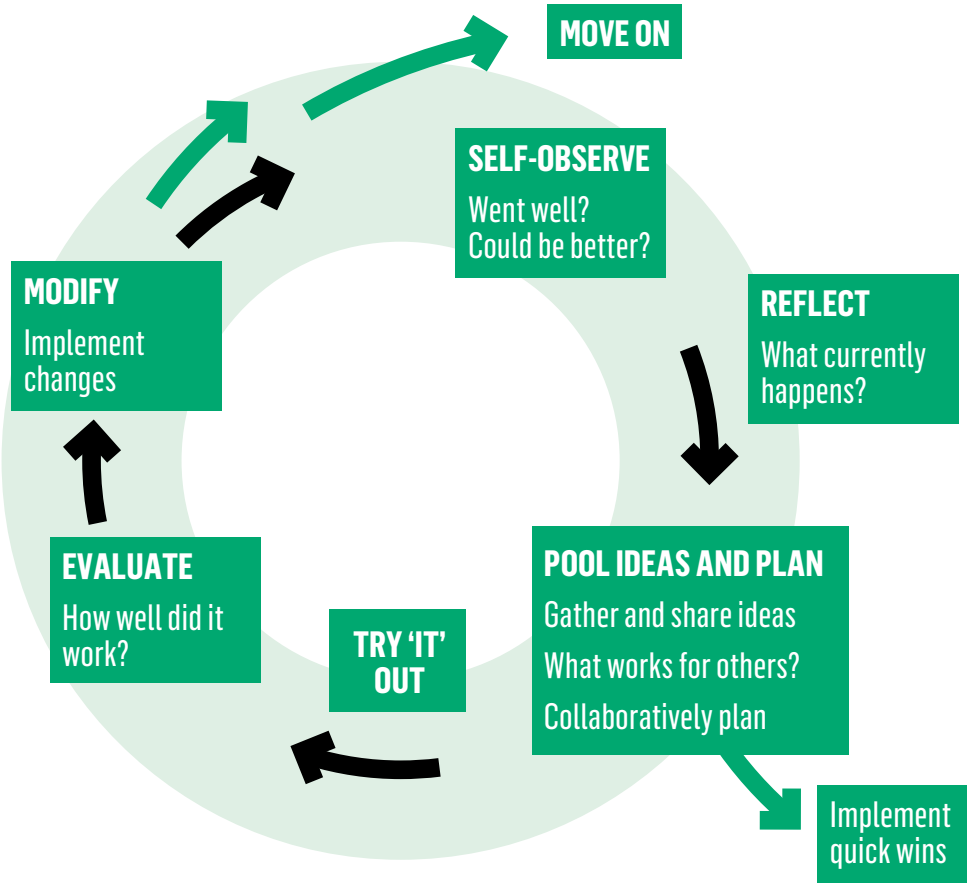
ACTION RESEARCH PLANNING WORKBOOK

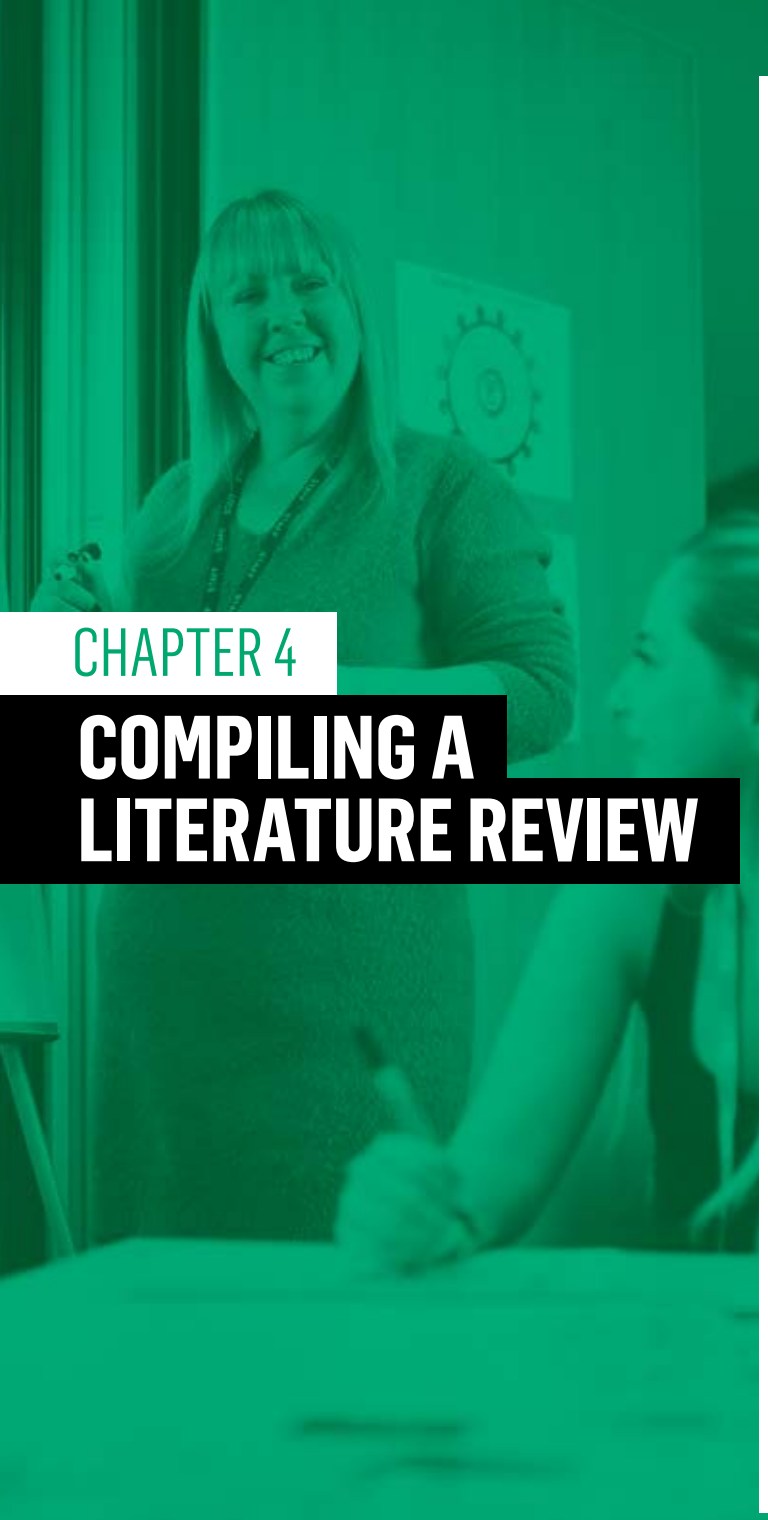
If helpful, adapt this **planning workbook**. It was produced as part of the DfE-funded Centres for Excellence in Maths programme.

ACTIVITY

PLAN YOUR ACTION RESEARCH CYCLE

Annotate this action research cycle **resource** with who will do what activity, by when.





CHAPTER 4

COMPILING A LITERATURE REVIEW

Doing a literature review can add hugely to the quality of your research and doesn't need to be onerous. Here are some pointers.

Why do a literature review?

Reviewing what literature has been published on your chosen topic is an efficient way to:

- learn new concepts and theories to deepen your understanding;
- find out practical ideas that have worked well elsewhere or experts recommend adapting and trying them out;
- build on what's gone before instead of reinventing the wheel;
- gain inspiration for your research; and
- help narrow and establish a precise research focus.

What is a literature review?

A literature review is a summary of previous research on different aspects of the topic that you are investigating. You'll need to identify relevant literature, possibly from different fields such as Education, Psychology, Technology, Mathematics Education etc. and figure out how these new understandings can shape your intervention. Findings, methods and/or the theoretical framing from your reading will all help you gather ideas to inform your research.

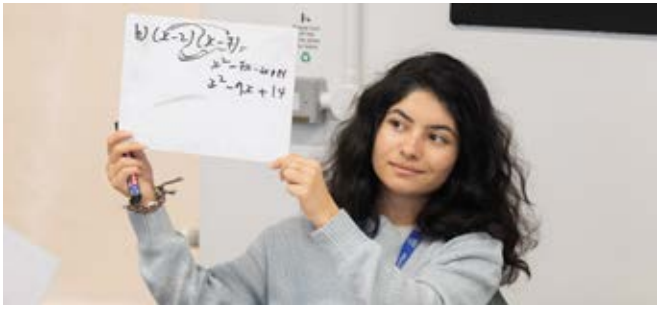
CHAPTER 4 **COMPILING A LITERATURE REVIEW**

Have FE teachers got time for this?

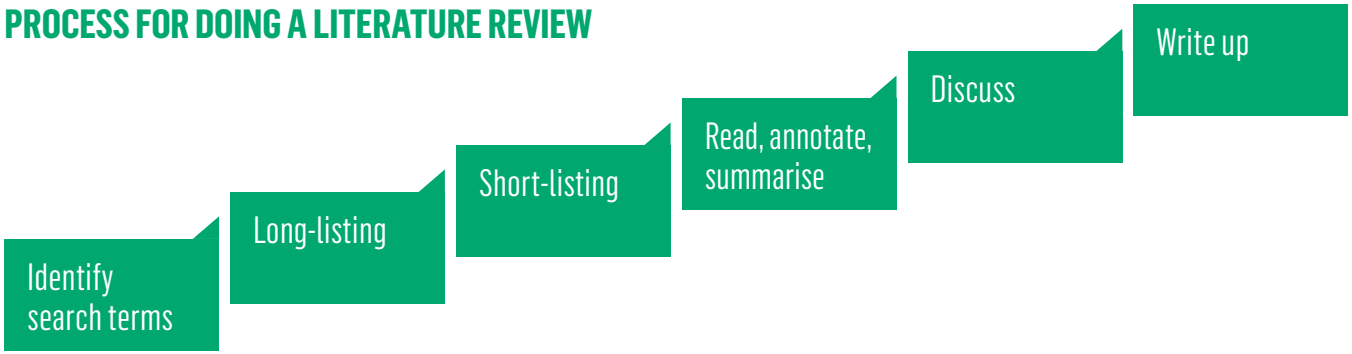
Because reading articles and writing them up is time-consuming, it's worth putting some effort into organising your literature review as early as possible. You'll benefit from realistic and sensitive project management skills. Define and allocate roles if you haven't already done so on your research timetable. Everyone involved needs to be comfortable with who is reading how much, how they will know what to read and who is doing the writing up – by when? While some teachers find time to read numerous articles, others can participate and benefit from reading one short article. One literature review will last you multiple action research cycles.

What's the process for doing a literature review?

There are different ways of tackling a literature review. These steps were used by practitioner-researchers on the CfEM programme. Consider the steps and supporting notes.



PROCESS FOR DOING A LITERATURE REVIEW



Identify search terms

- What words and phrases are relevant to your research? Start by identifying key words from your research question or title. See the example on the next page from Harlow College. The green font represents the phases the teacher-researchers highlighted as potential key words.
- Literature will exist on each of these search terms, but perhaps not all together in the same articles or may be from research not done in FE in England.

Long listing

- Perform online key word searches to find articles (and books) that could be relevant to one or more parts of your inquiry.
- Use Google Scholar, ResearchGate and other online portals. Does your organisation have a subscription to any journals? Check the references of one article to find others. Email authors to ask for articles – they're usually delighted to help!

Short listing

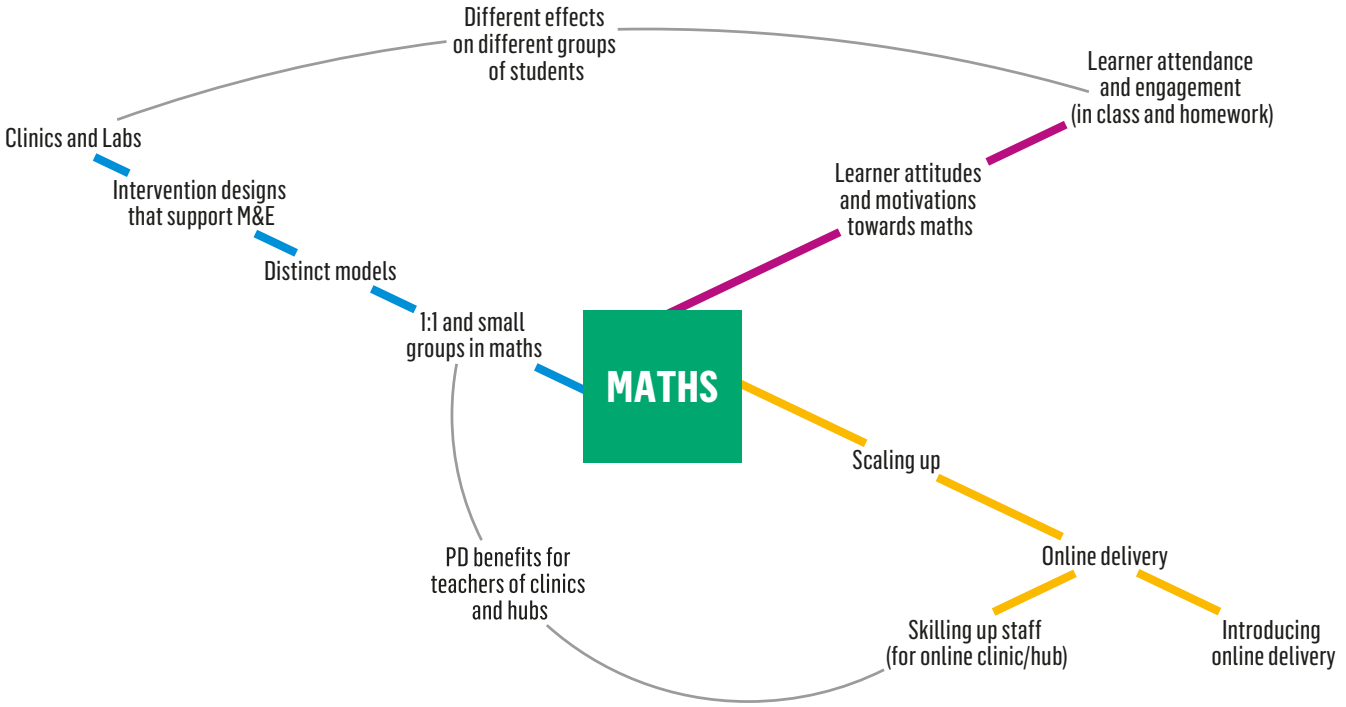
- Whittle down your longlist to a shortlist by eliminating articles not based on credible evidence, affiliation or not from a trustworthy source.
- Your short-list needs to be short enough to get through in the time available, i.e. detailed reading, notes summarising key points and possible quotes.
- A small research group might set a minimum of eight shortlisted articles between them.

Identify Research Terms - Example from Harlow College

Aim: How the use of one-to-one and small group tutorial/interventions can develop the motivation and engagement of FE maths learners.

Research objectives

1. To review the literature concerning the use of one-to-one/small group interventions outside the classroom.
2. To scale up the use of Maths Clinics (MC) and Maths Labs (ML) at Harlow College and Northampton College and introduce online delivery.
3. To design and deliver professional development to staff to upskill them to roll out the maths clinic approach.
4. To understand ways in which MC/ML impacts on learners' attitudes and motivation towards learning maths.
5. To investigate the effect of MC/ML on attendance and engagement in main maths classes and completion of homework.
6. To explore the benefits of MC/ML on professional development of teachers.
7. To compare the impact of the two different models of small group support.



8. To compare the impact of online verses face-to-face delivery.
9. To explore which features of MC/ML are particularly important in motivating and engaging students.
10. To determine which students are more likely to benefit from small group interventions.
11. To share our research findings more widely across college, network and beyond.

RESOURCE

LONG LISTING

Browse generic and maths specific **sources** to help you compile your long list.

Read, annotate, summarise

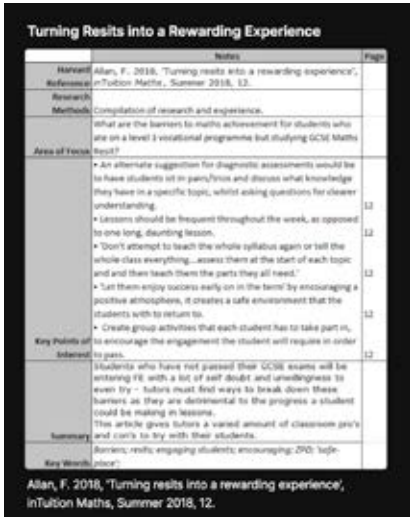
- Annotate by hand or electronically.
- Keep an abbreviated version of references after each quote and idea that doesn't come from you or your research group, for example (Jones, 2021). Going back to find references is extremely time-consuming!

Discuss

- Discussing what you've read is probably the most important stage of the process so do include this on your research timetable.
- Share copies of summary notes or annotations before so people have time to read them before meeting. Use the 'DISCUSS' questions to facilitate dialogue.

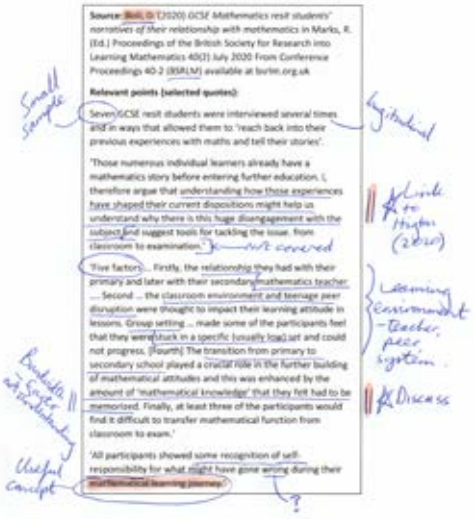
Write up

- Ensure the lead author has the confidence and time to sort the notes under sub-headings and to write up the literature review.
- Between 2 and 5 sides of A4 will do your topic justice. Use a structure: e.g, start with the general or theoretical, next what others found worked in practice and top and tail with an introduction and conclusions.
- Have a References section at the end of your report or presentation. Whichever format you use (such as Harvard), be consistent.
- Referencing or bibliography management tools can be useful.


Turning Resits into a Rewarding Experience

	Notes	Page
Harvard Reference	Allan, F. 2018. 'Turning resits into a rewarding experience', inTuition Maths , Summer 2018, 12.	
Research Methods	Compilation of research and experience.	
Area of Focus	What are the barriers to maths achievement for students who ate on a level 3 vocational programme but studying GCSE Maths resit?	
Key Points of Interest	• An alternate suggestion for diagnostic assessments would be to have students sit in pairs/trios and discuss what knowledge they have in a specific topic, whilst asking questions for clearer understanding. • Lessons should be frequent throughout the week, as opposed to one long, daunting lesson. • 'Don't attempt to teach the whole syllabus again or tell the whole class everything....assess them at the start of each topic and and then teach them the parts they all need.' • 'Let them enjoy success early on in the term' by encouraging a positive athosphere, it creates a safe environment that the students with to return to. • Create group activities that each student has to take part in, to encourage the engagement the student will require in order to pass.	12 12 12 12 12
Summary	Students who have not passed their GCSE exams will be entering FE with a lot of self doubt and unwillingness to even try - tutors must find ways to break down these barriers as they are detrimental to the progress a student could be making in lessons. This article gives tutors a varied amount of classroom pro's and con's to try with their students.	
Key Words	Barriers; resits; engaging students; encouraging; ZPD; 'safe-place';	

Allan, F. 2018, 'Turning resits into a rewarding experience', inTuition Maths, Summer 2018, 12.



Discuss

Q: What is most interesting/relevant/useful?

Q: What is new knowledge?

Q: What are and how would you use particular findings?

Q: Which aspects of your research aim/ question/title/objectives aren't addressed?

ACTIVITY

Explore two literature reviews written by FE maths teachers at **Leicester College** (pages 6-10) and **Cambridge Regional College** (pages 6-14).

CHAPTER 5

COLLECTING YOUR DATA

In this chapter we discuss what qualitative and quantitative data is good for. Whilst action research typically uses qualitative data, it can be useful to collect quantitative data too, as combining both allows you to examine your research question or title more fully.

What is data?

Data can take the form of survey results, interview text, observation notes, video/audio recordings, student work, teacher reflections and so on depending on your data collection instruments and ultimately your overarching research design.

What are qualitative methods good for?

- Capturing data in the form of **words**, that is, when you want a rich and complex understanding of your research topic.
- Exploring issues in depth and generating large volumes of data, which is why qualitative studies are usually small in scale, e.g. 5 to 30 participants.

Qualitative methods can be used to find out what people are thinking (views and attitudes); describe observable behaviours (physical and verbal); and explanations.

What are quantitative methods good for?

- Capturing anything you can **count**, to condense large numbers of responses into a few figures that make overall patterns and differences easy to see.
- When it's possible to predict most of the likely answers to your questions such as multiple choice answers on a questionnaire.

Quantitative methods can be used to find out the frequency, main types, trends and relative proportions of observed behaviours, attitudes and pieces of work.

Mixed methods

In practice, most action research projects use 'mixed methods': a combination of qualitative and quantitative approaches. Here are some examples.

- Using responses to an initial survey to select a smaller group of learners to follow up using more in-depth qualitative methods.
- Collecting demographic data about participants of focus groups or observations.
- One 'open' question requiring an 'open' written response in a text box in a questionnaire of 'closed' questions, possibly to explain a previous answer or share 'any other comments.'
- Tallying of instances of particular behaviours/ words heard or/and tallying of written descriptions when doing observations.

RESOURCE

Which groups of people are eligible for your inquiry? Of these, who and how many should you invite?

Review this **3-step process and examples**.

Qualitative data collection methods

Review these qualitative **data collection methods** (including pros and cons) before choosing which are right for your inquiry. No one method can provide a full picture but using a combination of methods leads to high quality analysis. Read up on any one method in detail online or/and in a research methods textbook such as Colin Robson's Real World Research*.

Observation - an FE maths teacher taking notes during a 15 minute observation of a small group activity.

Interview - an FE maths teacher doing a 10 minute one-to-one interview.

Documents - post-it notes responding to three questions, with 'voting stickers' from others who agree with a comment.

Focus group - of FE maths learners able to stay on after a lesson, audio-recorded, with an engaging mix of discussion questions and practical activities.

Learners' work - examples showing completed work and work in progress.

Teacher's reflective journals - regular notes relevant to the research topic.

Quantitative data collection methods

Questionnaires are excellent at collecting large volumes of mainly closed data in a time-efficient way. But there are other quantitative data collection methods, too.

Questionnaires

Typically used to survey a lot of people to find out frequencies and patterns of responses to 'closed' questions.

Prepare a list of questions, each one directly relevant to your inquiry. Carefully think through the likely answer options for each of your 'closed' questions and which question format to use – multiple choice (single answer only), multi-code (multiple answers allowed), matrix (rating scale), etc. Consider using software such as Microsoft/Google Forms for efficient data collection and analysis.

Tips:

- Aim for a length that matches the likely concentration span of respondents, typically between 7 and 15 minutes (25 quick or 10 multi-parts 'closed' questions plus one/two 'open' free text questions.)
- Keep language simple and clear. Avoid double-header questions (do you like maths and are you good at it?) Avoid leading questions.

RESOURCE

*Real World Research by Colin Robson, published by John Wiley and Sons, is in its 5th Edition. Extremely useful and affordable second-hand copies of earlier editions are available. You may also like Jean McNiff's freely available booklet **Action Research for Professional Development** suitable for teachers new to action research.

- Ask about attitudes, perceptions, opinions, views, recent experiences, ideas for the future, improvements and suggestions. Avoid questions that are hypothetical, sensitive and on topics outside of respondents' experiences.
- Add 'don't know' and/or 'not applicable' as extra answer option(s) to all questions that may need it.
- Arrange for someone to pilot an early version to check for length, relevance to your research, wording and to proofread.

Focused maths assessments

Selected questions from previous maths exam papers or questions focused on a specific maths area. These can be effective before, after or at points during an intervention. Results indicate learner competence, skills and progress over time.

Learner snapshots

Nasrin wanted to find out how confident her new Functional Skills learners were with basic number operations. When she asked the class verbally, many learners were reluctant to speak up. She changed to the anonymous, quantitative approach. It worked!

How confident are you about doing problem solving in maths?

Here is a maths question.

Don't answer the question.

Tick one box

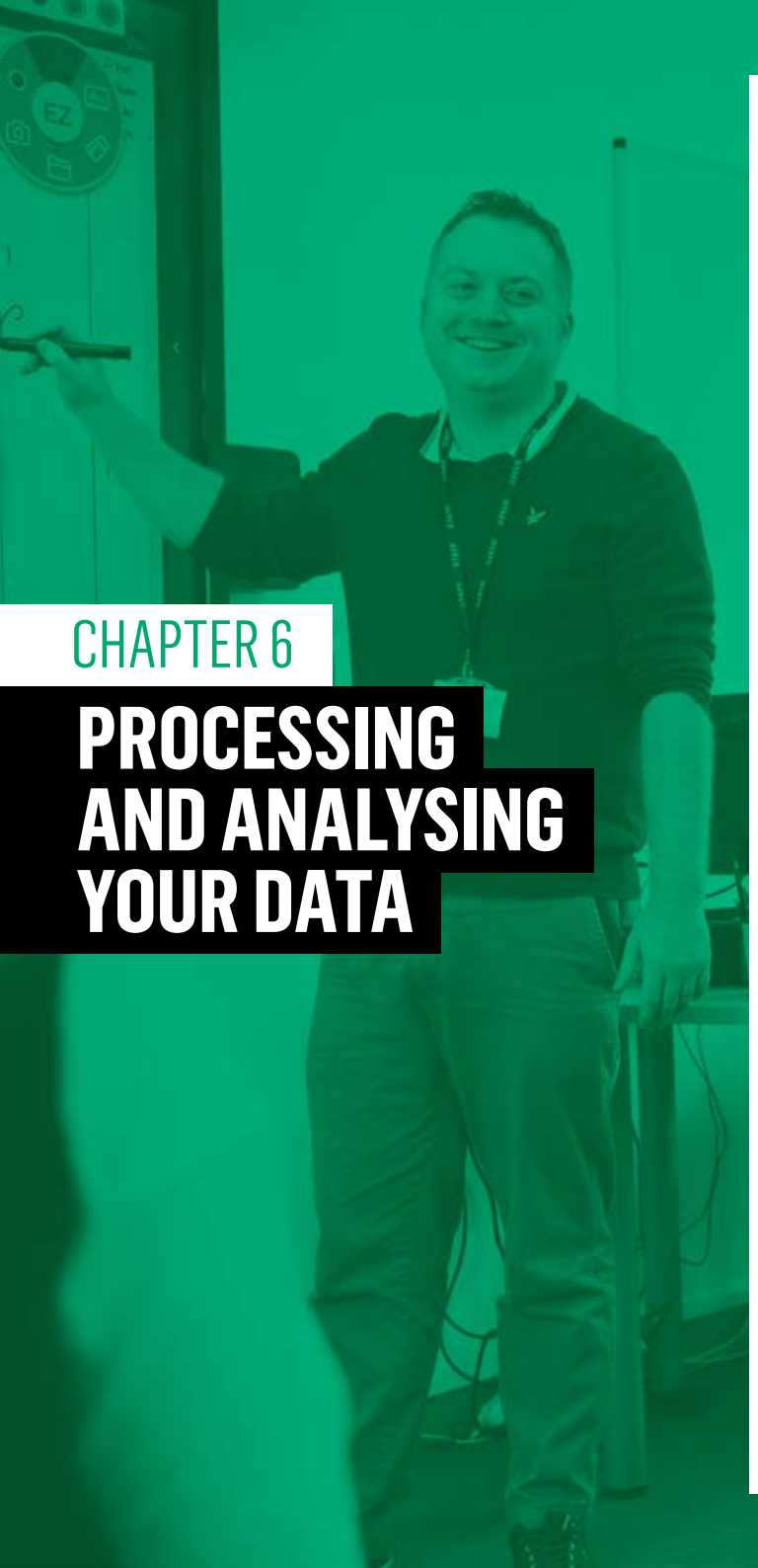
- ☐ **I know how to tackle this question**
- ☐ **I think I could make a start on the question**
- ☐ **I could write one thing down or start a diagram**
- ☐ **I don't have a clue where to start**

Management information system

Often routinely collected, these data should be used if relevant to your inquiry. For example, you may be particularly interested in improving attendance, type or duration of homework completed, or assessment data showing skills gaps.

Online data collection

While most data will be collected face-to-face, sometimes it's more efficient or only possible to do so remotely, online. Here are some **practical tips** to get you started with online data collection.



CHAPTER 6

PROCESSING AND ANALYSING YOUR DATA

Researchers need to process and analyse the data collected as part of their research so that readers can make sense of it. As a teacher-researcher you'll select and summarise relevant data and, ultimately, draft conclusions and recommendations to inform future practice. You might find the mnemonic DIKI helpful, as you first turn numerous relevant pieces of granular data into information (descriptive summaries and selections of data) and then, through thoughtful analysis, into useful knowledge and useable insights.

D = Data **I = Information** **K = Knowledge** **I = Insights**

Remember to process data before you analyse it

High quality data and information can be relied on to provide useful knowledge and useable insights.

Beware of 'bad' data that is unorganised, including blanks (missing responses) or irrelevant 'don't know'/'not applicable' type responses in subsequent calculations, and/or is irrelevant to your research question or title.

CHAPTER 6 PROCESSING AND ANALYSING YOUR DATA

Data processing

Getting the data ready for analysis

GET READY

- **Identify:** be clear about what data you have actually collected
- **Digitise:** if paper-based data scan and upload. Upload photographs. Transcribe interviews
- **Store:** store data securely and in one place

GET SET

- **Clean:** systematically review each cell of data/example of student work/diary entry etc. removing irrelevant answers, deciding what to do with blank responses and missing data
- **Anonymise:** remove information that could identify an individual/organisation

GO!

- **'Eyeball':** look through your data so you are familiar with the content before analysing it. Note everything that immediately strikes you as interesting.

Qualitative data analysis

Qualitative data is collected through interviews, focus groups, observations, teachers' reflective journals, written responses within surveys, learners' written work including use of maths symbols, and so on. The most common qualitative data analysis technique is 'coding', which means systematically labelling each item of data with a 'code' and then counting the frequency of each 'code' to identify common and important themes in the data. It is one of the most time-consuming parts of action research, but it's worth it. Coding aggregates and condenses large volumes of qualitative data. While coding, also look out for quotes and examples that are typical or unusual.

EXAMPLE OF CODING

Learner	Teacher	Learner feedback before flipped learning was introduced: 'What do you think about doing 20 minutes of maths a week - video, activity, quiz - before coming to a lesson to learn more on that topic?'	Code
1	AH	I need a teacher there to ask questions and learn	need teacher - to ask questions and to learn
2	AH	Teachers explain things how I understand it best. I'd have a go.	need teacher – to explain things and to learn
3	AH	It's boring on your own	boring - on own
4	AH	It's boring watching maths videos. Who wants to watch maths videos?	boring – watching maths videos
5	AH	I can watch a video but don't know how much it will sink in.	will watch a video– but uncertain how much will learn
6	AH	More maths?!	unwilling to do any 'more maths'
7	AH	Teachers being there make you do the work. I learn best with a teacher with me.	need teacher – makes you do the work

Quantitative data analysis

Maths teachers are less likely to need advice on quantitative data analysis, but below is some guidance on using descriptive statistics in action research.

- **Base sizes** - Note how many respondents each result is out of. It helps to keep your findings in perspective, and you'll need this information for accurate reporting e.g. 54 out of 60 learners. 17% of the 200 questions marked.
- **Graphs, charts and tables** - When clearly labelled, bar graphs, histograms, line graphs, pie charts and box-and-whisker plots can literally show frequencies, change and spread of data.
- **Frequencies, basic fractions and rough proportions** - Action research projects typically have under 100 respondents in which case it's appropriate to use frequencies, fractions or proportions. Examples of phrases to use: 'approximately three quarters (13) of the 16 learners who were asked X agreed that Y', 'the large majority…', 'a significant minority…'.
- **Percentages** - Widely understood and very commonly used in quantitative research. Percentages give an accurate view of the prevalence or trends if the base size is close to or above 100. Using percentages could be misleading if you did an intervention with 6, 30 or even 70 learners.
- **Measures of central tendency and spread** - Explore what mean, median and mode could add to your analysis as well as indicators of range, quartiles and standard deviation.

VIDEO

CODING IN ACTION

In this **video-resource** [16 mins] Cath Gladding - from the ETF - models an approach to coding, step-by-step.

Advanced Analysis

Triangulation is a term used by researchers to mean the drawing together of various sources of information that have been collected on the same topic from **different** perspectives.

It's called triangulation because it was originally about connecting three sources of data but nowadays refers to any number. Triangulation helps give you a fuller, more rounded picture.

For example, you might:

- collect video data on a pair of learners working with manipulatives to develop their understanding of ratio;
- issue a learner survey to the same learners to assess their confidence in ratio and attitudes towards using manipulatives in class after six lessons; and
- invite their teacher to write a reflective journal entry every week throughout the six-week manipulatives intervention.

This provides three sources of complementary data. Two of these are primarily qualitative (video and reflective journal) and the third (learner survey) is quantitative.

RESOURCE

HOW TO RUN A DATA ANALYSIS WORKSHOP

Once you have analysed your data, run a data analysis workshop to efficiently identify and agree conclusions and recommendations from the research. Access this **resource** to help plan the workshop.

CHAPTER 7

SHARING YOUR RESEARCH FOR IMPACT AND IMPROVEMENT

Now you have completed your investigation others within your organisation and across the sector will be interested in hearing about what you have found out. Nowadays, reporting on your research can take many formats. Reporting can be formal or informal and include a written report, presentation or poster.

Devising a short communications plan will help organise this stage of your work. Use the 'Ideas for Sharing Research' activity as a starting point. Ask colleagues from your research group or business development team to help you. Prioritise what you want to say, to whom, and why about your research findings.

RESOURCE

IDEAS FOR SHARING RESEARCH

Explore the ideas in this **resource** to get you started on your communications plan.

Writing and publishing a research report

If you want to produce a written report, consider including the following, adjusting the contents and length depending on who and what it is for:

- title page;
- summary/abstract;
- introduction;
- literature review;
- research methods;
- description of intervention;
- results/data and;
- conclusions and recommendations.

If you want to get published, choose an outlet - for example, blog, newsletter or academic journal - by looking carefully to see that your contribution will fit and then follow the required style and length as set out by the editor or in the notes for contributors.

Reading reports and watching video-presentations from FE maths teachers will help you see how other FE maths teachers have shared their research.

RESOURCE & VIDEO

WRITTEN REPORTS AND VIDEO-PRESENTATIONS

Dip into FE maths teachers' action research reports from the CfEM programme to see how they wrote up their research (2021 and 2002).

Watch FE maths teachers present their action research in 20 minutes! at the CfEM Live conferences (2021 and 2022).

Access them all from the action research **web-page**.

CHAPTER 8

WHAT'S NEXT?

Implement your findings

What are the main conclusions from your research that you can put into practice?

What are the main conclusions that you need to talk to colleagues about before they can put them into practice?

Reflect on your experience of doing action research

Would you do it again?

What could be better next time?

Move on to another action research cycle

What do you want to research next?

Who could you work with?

When can you start and finish the next cycle?

Reflecting on your research practice

Reflecting back on their experience, FE maths teachers who led and participated in collaborative action research projects as part of the CfEM programme between 2018 and 2023 said that they met almost every one of the **Professional Standards** for Teachers and Trainers in the Further Education and Training sector.

Professional Standards

for Teachers and Trainers in the Further Education and Training Sector

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Professional Values and Attributes

Develop your own judgment of what works and does not work in your teaching and training.

1. Critically reflect on and evaluate your practices, values, and beliefs to improve learner outcomes.
2. Promote and embed education for sustainable development (ESD) across learning and working practices.
3. Inspire, motivate, and raise aspirations of learners by communicating high expectations and a passion for learning.
4. Support and develop learners' confidence, autonomy and thinking skills, taking account of their needs and starting points.
5. Value and champion diversity, equality of opportunity, inclusion and social equity.
6. Develop collaborative and respectful relationships with learners, colleagues and external stakeholders.
7. Engage with and promote a culture of continuous learning and quality improvement.

Professional Knowledge and Understanding

Develop deep and critically informed knowledge and understanding in theory and practice.

8. Develop and update knowledge of your subject specialism, taking account of new practices, research and/ or industry requirements.
9. Critically review and apply your knowledge of educational research, pedagogy, and assessment to develop evidence-informed practice.
10. Share and update knowledge of effective practice with colleagues, networks and/or research communities to support improvement.
11. Develop and apply your knowledge of special educational needs and disabilities to create inclusive learning experiences.
12. Understand your teaching role and responsibilities and how these are influenced by legal, regulatory, institutional and ethical contexts.

Professional Skills

Develop your expertise and skills to ensure the best outcomes for learners.

13. Promote and support positive learner behaviour, attitudes and wellbeing.
14. Apply motivational, coaching and skill development strategies to help learners progress and achieve.
15. Plan and deliver learning programmes that are safe, inclusive, stretching and relevant to learners' needs.
16. Select and use digital technologies safely and effectively to promote learning.
17. Develop learners' mathematics, English, digital and wider employability skills.
18. Provide access to up-to-date information, advice and guidance so that learners can take ownership of their learning and make informed progression choices.
19. Apply appropriate and fair methods of assessment and provide constructive and timely feedback to support learning and achievement.
20. Develop enrichment and progression opportunities for learners through collaboration with employers, higher education and/or community groups.

To find out more about our Professional Standards updated in 2022, visit: ETFOUNDATION.CO.UK/PROFESSIONAL-STANDARDS/TEACHERS

Continue developing your research practice

Ask colleagues if they want to collaborate on a new cycle of action research.

Talk to your manager about the possibility of getting some remission time to continue your research.

Keep an eye out for internal and external funding for action research.

Join an action research network such as the ETF's Practitioner Research Special Interest Group (open to SET members) or Learning and Skills Research Network (LSRN).

Consider continuing your action research as part of a qualification or gaining a status such as a Master's degree or Advanced Teacher Status (ATS.)

QUOTE

"Working with colleagues to see what new approaches work best with our students has been really enjoyable."

FE maths teacher, Leyton Sixth Form College

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VISIT: etfoundation.co.uk
TEL: +44 (0) 20 3740 8280
EMAIL: enquiries@etfoundation.co.uk

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