

CHANGING THE EXPERIENCE OF FE MATHS - SUMMARY

CFEM SUMMARY REPORT

SYNTHESIS OF ACTION RESEARCH REPORTS 2021/22



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Summary of CfEM action research findings, 2021/22

Summary

Introduction

Between 2018 and 2023, the DfE funded Centres for Excellence in Maths (CfEM), a research and development programme designed to upskill and put teachers at the heart of innovations to improve attainment in maths GCSE resit results for 16 to 19 year olds across England. In 2021/22, just 15.3% of maths GCSE resit learners aged 16 to 19 years achieved a grade 4 or higher.

This document contains the summary and conclusions of the action research strand of the CfEM programme. It is evidence of how **numerous incremental improvements were** made in the teaching of FE maths in the academic year 2021/22, with significant positive impacts on the knowledge, skills and attitudes of learners and participating teachers, within the very challenging context of compulsory maths resits.

The full report, together with the 40 individual action research reports upon which it is based, are available at: <https://www.et-foundation.co.uk/professional-development/maths-and-english/cfem/cfem-resources-and-evidence/cfem-evidence/cfem-action-research-resources/>.

Summary of CfEM action research topics

Theme	Topics chosen for research
Teaching for understanding How can we develop learners' conceptual understanding and support their reasoning and problem solving skills?	- Using models and representations to reveal mathematical structure and support conceptual understanding (a) Visual models & representations (b) Use of manipulatives - Language issues in maths learning
Teaching responsively How can we deliver a maths curriculum that is responsive to the gaps in learners' skills and understanding?	- Diagnostic assessment approaches for identifying skills gaps - Teaching approaches for addressing misconceptions and filling skills gaps
Engagement and resilience How can we engage learners and overcome negative attitudes, anxiety and fixed mindsets?	- Strategies for addressing anxieties and negative mindsets - Coaching and mentoring approaches - Promoting engagement with mathematical problem solving and multi-mark exam questions - Creating positive learning environments

Conclusions and Recommendations

These studies provide a rich, context-specific understanding that may not be easily replicated across settings. However, some general conclusions can tentatively be drawn from the consistency of certain findings from across multiple projects and settings:

1. Action research was found to be a powerful model for continuous professional development. As a result of doing collaborative action research, the FE maths teachers:
 - **implemented their own and adapting others' action research findings to improve learners' experience and learning**
 - **felt confident inquiring into and changing their own practice, using action research cycles as a framework**
 - **used action research findings to develop further tools and resources for use across the maths FE sector**
 - **gained valuable research and project management skills, with Centre Leads and Action Research Leads gaining new management skills**
 - **met the vast majority of the ETF's Professional Standards for FE Teachers and Trainers.**

⇒ For action research to be successful, staff needed: (i) initial training and ongoing support in research methods and research project management and (ii) individual resilience, people to collaborate with to greater or lesser extents and supportive management. After 2-3 years, FE maths teachers began to feel competent and confident enough for action research to become part of their ongoing practice.
2. Addressing barriers to learning maths is key in addressing the low attainment of post-sixteen resit cohorts. Teachers found the results of questionnaires on learners' attitudes to maths enlightening. A range of approaches to developing engagement and resilience were found to boost confidence and willingness to participate, with knock-on effects for attendance and progress.
 - ⇒ Engagement and resilience should be viewed as essential, prerequisite, to FE maths resit teaching and learning.
 - ⇒ Teachers should learn and then teach basic theories and modern neuroscience about how the brain works and theory of mindsets at the beginning of the year. Learners should then have opportunity to practice using these strategies, with reminders and support, throughout the year. The focus should be on regular self-identification of mindset and use of appropriate ways to improve motivation to do more maths and attempt exam-style questions.
3. Visual representations – double number lines, ratio tables and bar models – were introduced with considerable success for learners who didn't already have a secure method.
 - ⇒ Representations should be introduced early in the year and then regularly demonstrated in a range of maths topics (percentages, ratio, fractions, X Y) for percentages, ratio, fractions and X. They particularly support those learners without a method they can confidently use to access these maths topics and for learners who already have a method to take on more challenging/varied questions.
4. Manipulatives were introduced to small groups of learners with misconceptions or without secure understanding of maths concepts, for example, two-colour counters for zero sum pairs, algebra tiles for proportion, geoboards for rotational symmetry and nets for properties of 3D shapes. Contrary to previous research, 16-19 year olds doing FE maths resits do accept physical manipulatives.
 - ⇒ Teachers will need to build their own confidence and experience at using manipulatives before introducing them to learners. Manipulatives need purchasing or making.

- ⇒ Greatest success came from teachers working with manipulatives with small groups of learners (while others in the class are doing more independent tasks).
5. The project on teaching mathematical terminology is one of four on the same topic that done over three years and all arrived at a similar conclusion: improved performance on assessments could be attributed to understanding of command words.
- ⇒ FE teachers should review lists of command words published by examination bodies, teach the meanings of ten (or more) of these words near the beginning of the year. Then regularly draw attention to these words and give learners regular opportunities to practice using this knowledge to answer exam-type questions.
6. FE maths resit learners benefited from teachers contextualising maths topics, making relatable what can otherwise an abstract curriculum, leading to both deeper understanding and engagement.
- ⇒ Explanations of real-life applications of maths should be integral to FE maths teachers' practice, drawing on ideas of Real Mathematics Education (RME).
 - ⇒ FE maths teachers should establish working relationships with teachers from vocational areas and co-design resources with them.
7. The use of responsive teaching processes were attributed to successful identification and filling of learners' skills gaps. The central premise is not re-teaching what learners already know. Successful responsive teaching approaches involved a series of steps that soon evolved into significant changes in practice away from teacher as instructor and towards teacher as learning facilitator.
- ⇒ Even the most efficient approaches to responsive teaching are time-consuming, even with elements of automation, and therefore efficiency is key. Whatever approach is taken, there must be sufficient time for the teacher to do the necessary data processing and analysis between lessons.
8. Coaching and mentoring approaches were found by teachers and learners to improve engagement and mathematical resilience, with one Centre attributing grade improvement to combined in-class and out-of-class mentoring.
- ⇒ Coaching and mentoring is an expense that the vast majority of colleges are unable to sustain without CfEM funding, but action research has shown that teachers can learn and use coaching and mentoring techniques. FE maths teachers have much to learn from using coaching and mentoring techniques that they should use in class.

Evidence-base

The full evidence base for this synthesis is available as full research reports and short video presentations at: <https://www.et-foundation.co.uk/professional-development/maths-and-english/cfem/cfem-resources-and-evidence/cfem-evidence/cfem-action-research-resources/>

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