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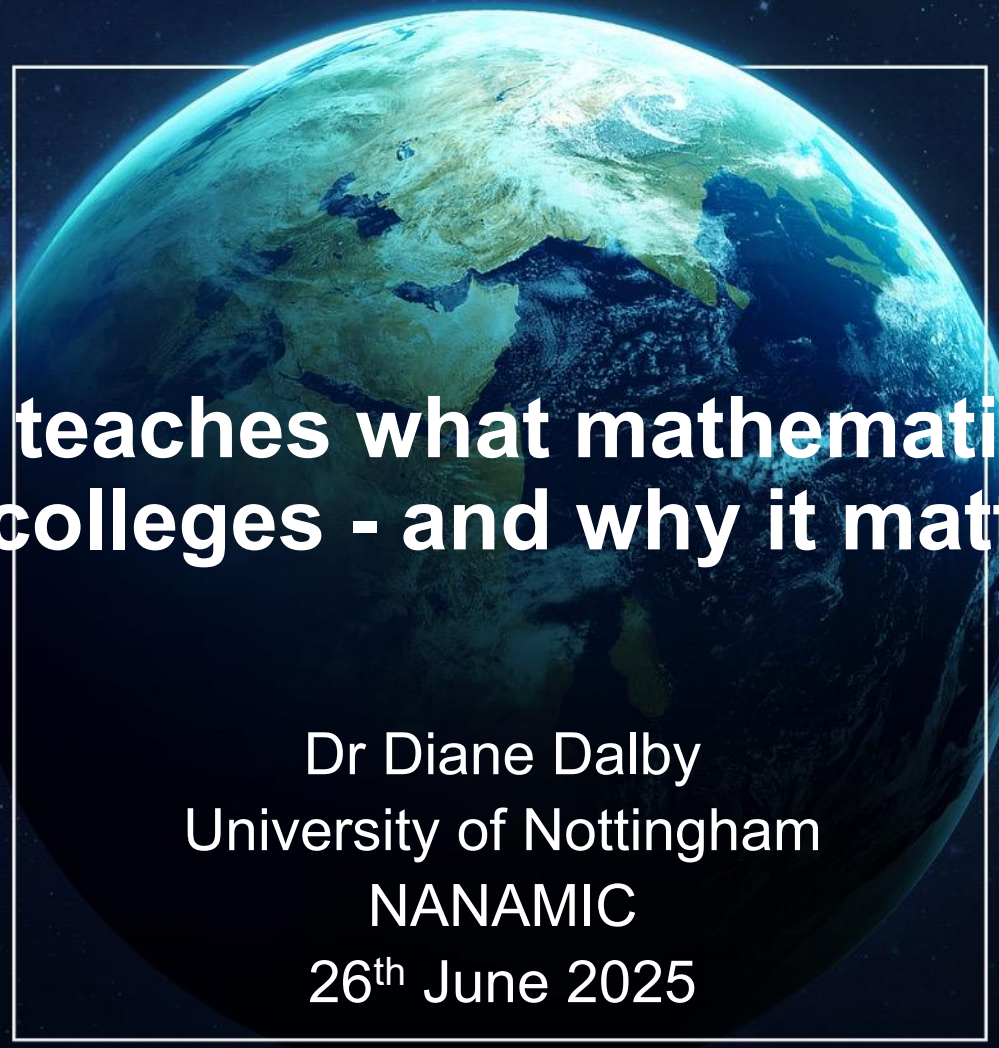

Who teaches what mathematics in FE colleges - and why it matters

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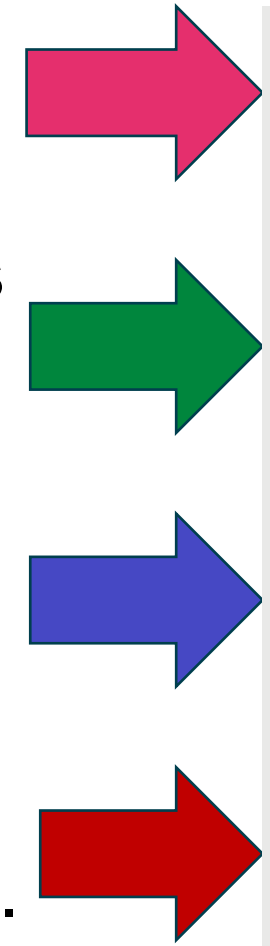
NANAMIC
26th June 2025

Projects

- Mathematics in FE Colleges (MiFEC) 2017-2020
- Centres for Excellence in Maths (CfEM) 2019-2023
- Whole College Approach (WCA) 2021-2023
- Maths in T levels 2024-2025

Professional identity

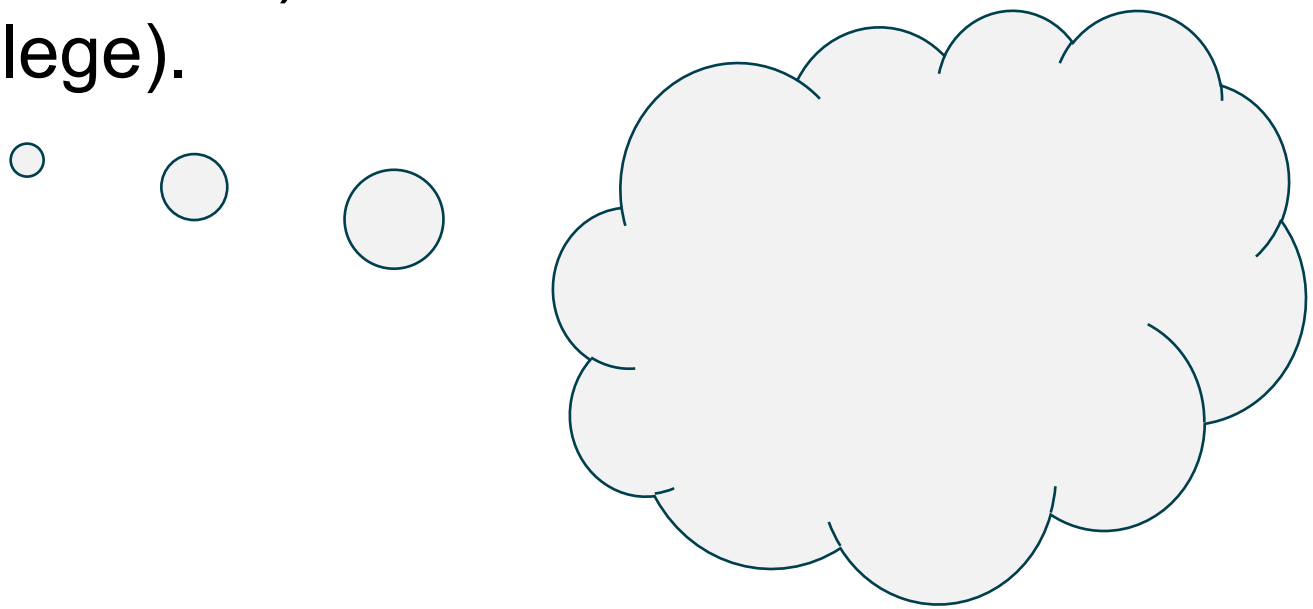
- Shaped by **social interactions** (Holland, 2001).
- Situated within narrative, **constructed and reconstructed discursively** in different social situations (Sfard and Prusak, 2005).
- Influenced by **reflection on 'significant' activities** and experiences that contribute to a 'leading identity' (Black et al., 2009).
- Related to the way in which individuals position themselves within **communities of practice** (Wenger, 1999; Wenger & Snyder, 2000; Bathmaker & Avis, 2006).



Analytical framework

Three areas of influence on professional identity (Day, Sammons, and Stobart 2007):

- Professional (general or occupational)
- Local (college, department, team)
- Personal (life outside college).



Maths in the FE context

- **A level:** understanding of advanced level maths
- **Core maths:** application of maths in ‘real life’ contexts
- **GCSE**: understanding of maths concepts and processes
- **Functional skills**: application of maths in various contexts

- **Maths in T levels**: competency-based approach
- **Maths in vocational programmes**: maths embedded in specific workplace contexts
- **Maths in apprenticeships:** maths embedded into work processes

Post-16 mathematics qualifications

Qualification	Level	Key features	Focus
A level	Level 3	Developing knowledge and understanding of advanced mathematical concepts and processes	Academic knowledge
Core maths	Level 3	Application of mathematics in a range of ‘real life’ contexts.	Application
GCSE	Level 2	Developing knowledge and understanding of mathematical concepts and processes.	Academic knowledge
Functional Skills mathematics	Entry level to Level 2	Application of mathematics in a range of familiar and unfamiliar ‘real life’ contexts.	Skills development

MiFEC project reports

Mathematics in FE colleges

- Interim report 1: Workforce survey
- Interim report 2: Policy enactment in colleges (case studies)
- Interim report 3: Student perspectives
- Interim report 4: Student progression with maths
- Final report

https://www.nottingham.ac.uk/research/groups/crme/projects/mifec/index.aspx

Teacher backgrounds

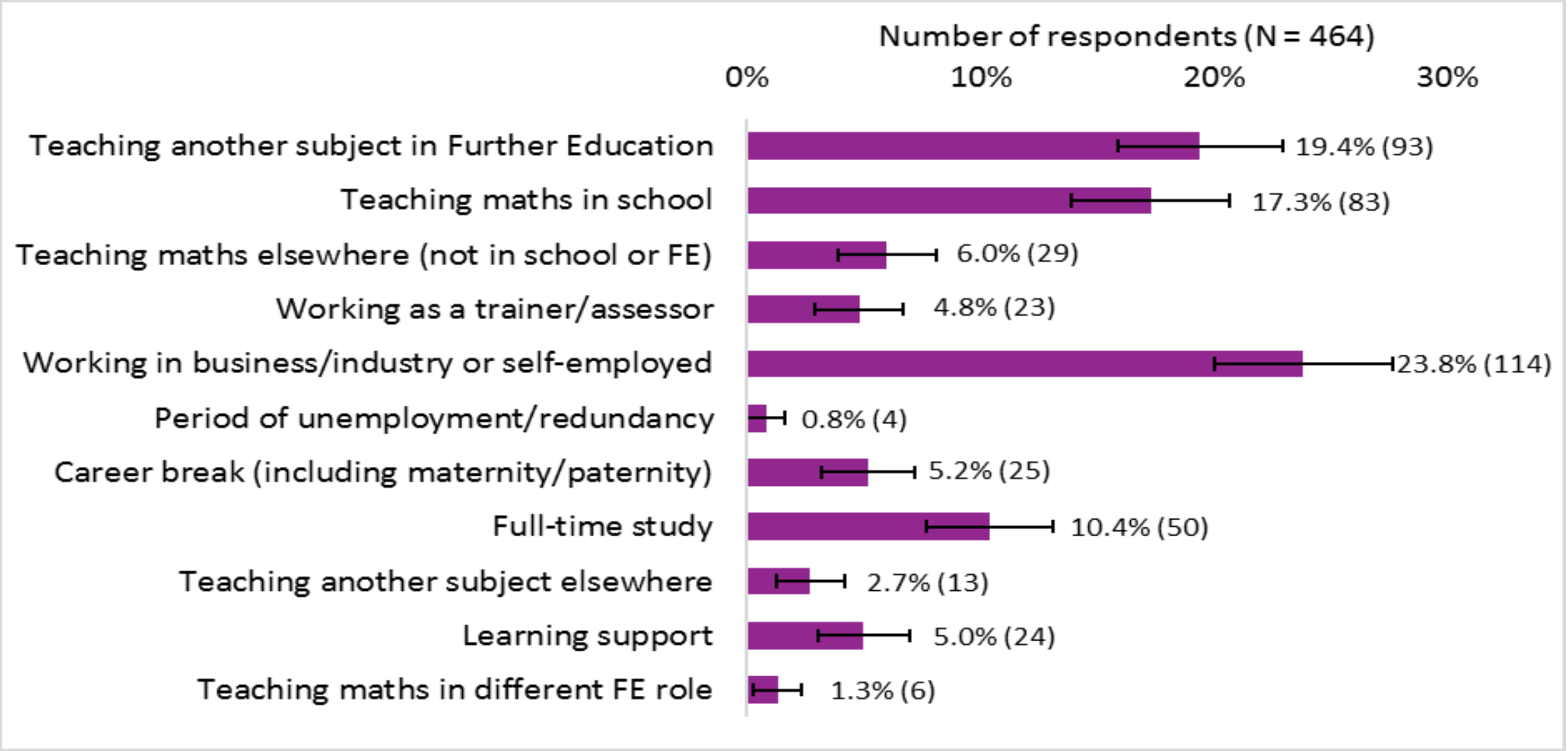


Figure 9: The percentage of respondents who selected each option for their previous main employment. Error bars show 95% confidence intervals for the percentages.

Age profile

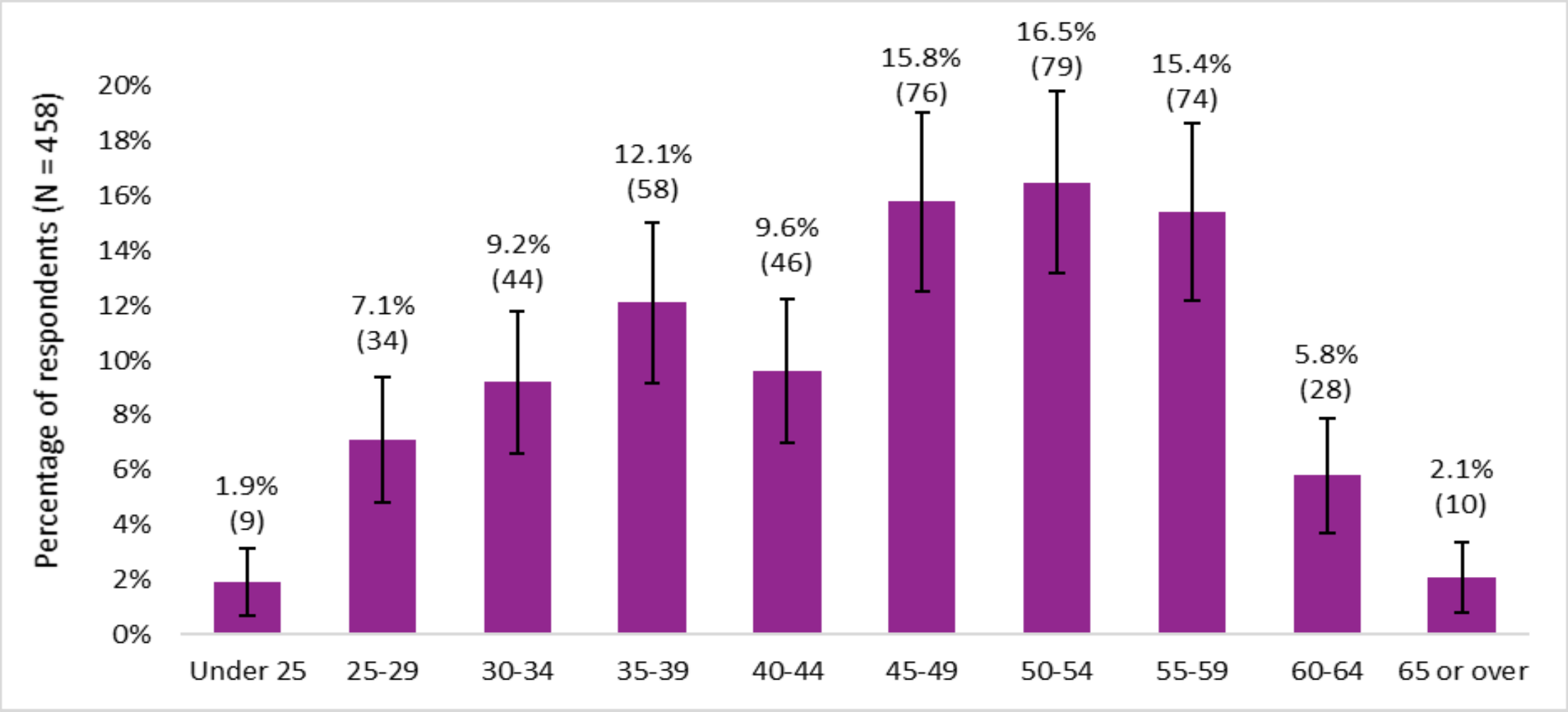


Figure 2: Percentage (and number) of respondents in each of the ten age groups displayed in the survey. Error bars indicate the 95% confidence intervals for the percentages.

Highest maths qualifications

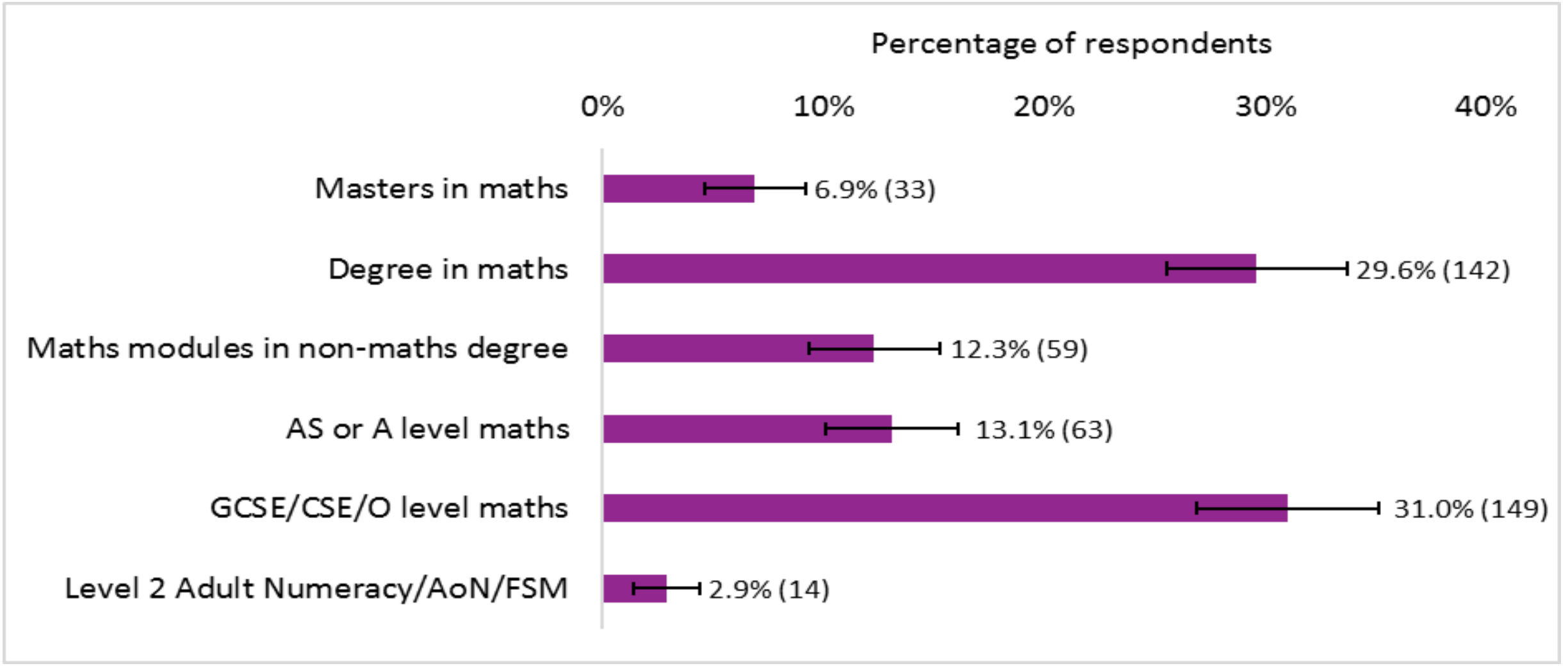


Figure 12: Percentage of respondents reporting each mathematics qualification as their highest. Respondents were asked to select all mathematics qualifications that they had attained and the graph shows the highest qualification selected. Error bars show the 95% confidence intervals for the percentages.

How are they employed?

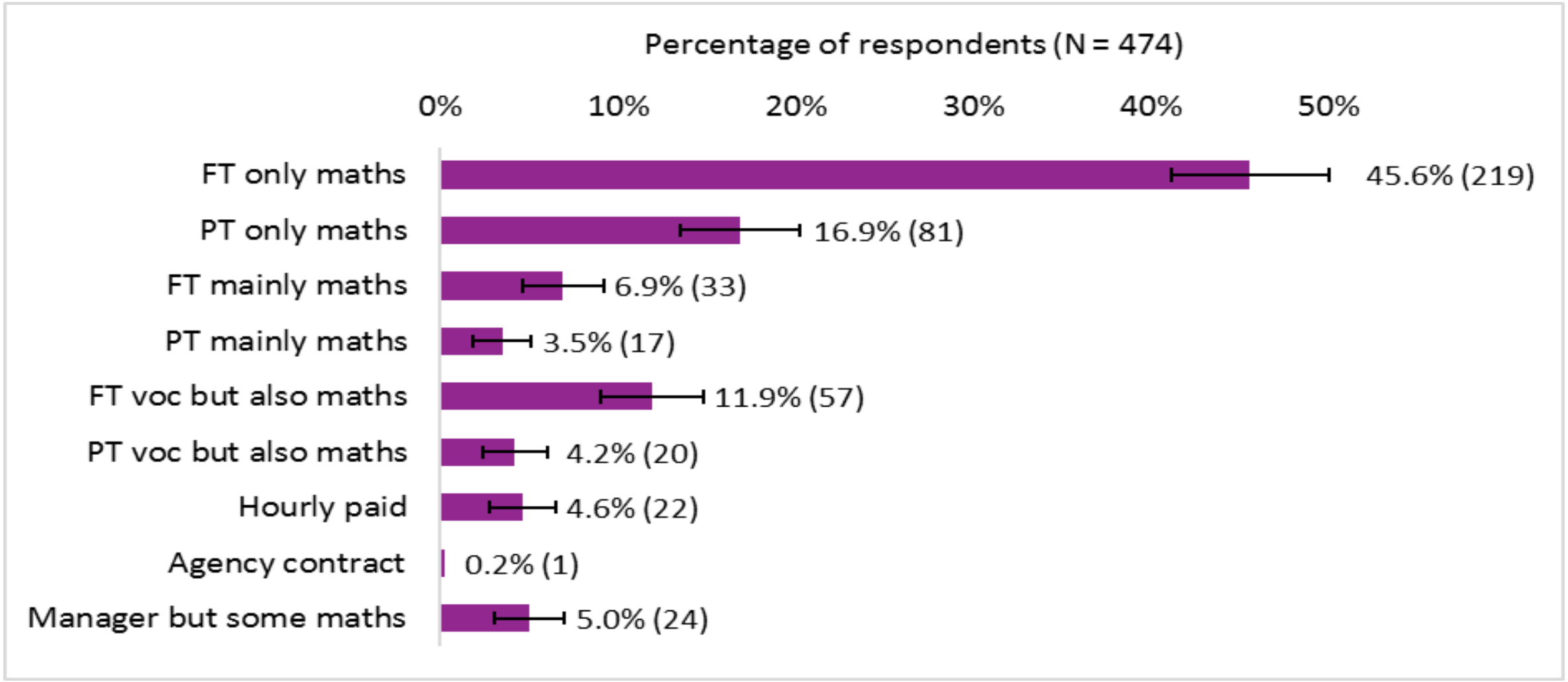


Figure 3: Percentage (and number) of respondents in each of the nine employment categories displayed in the survey. Error bars show the 95% confidence intervals of the percentages.

What do they teach?

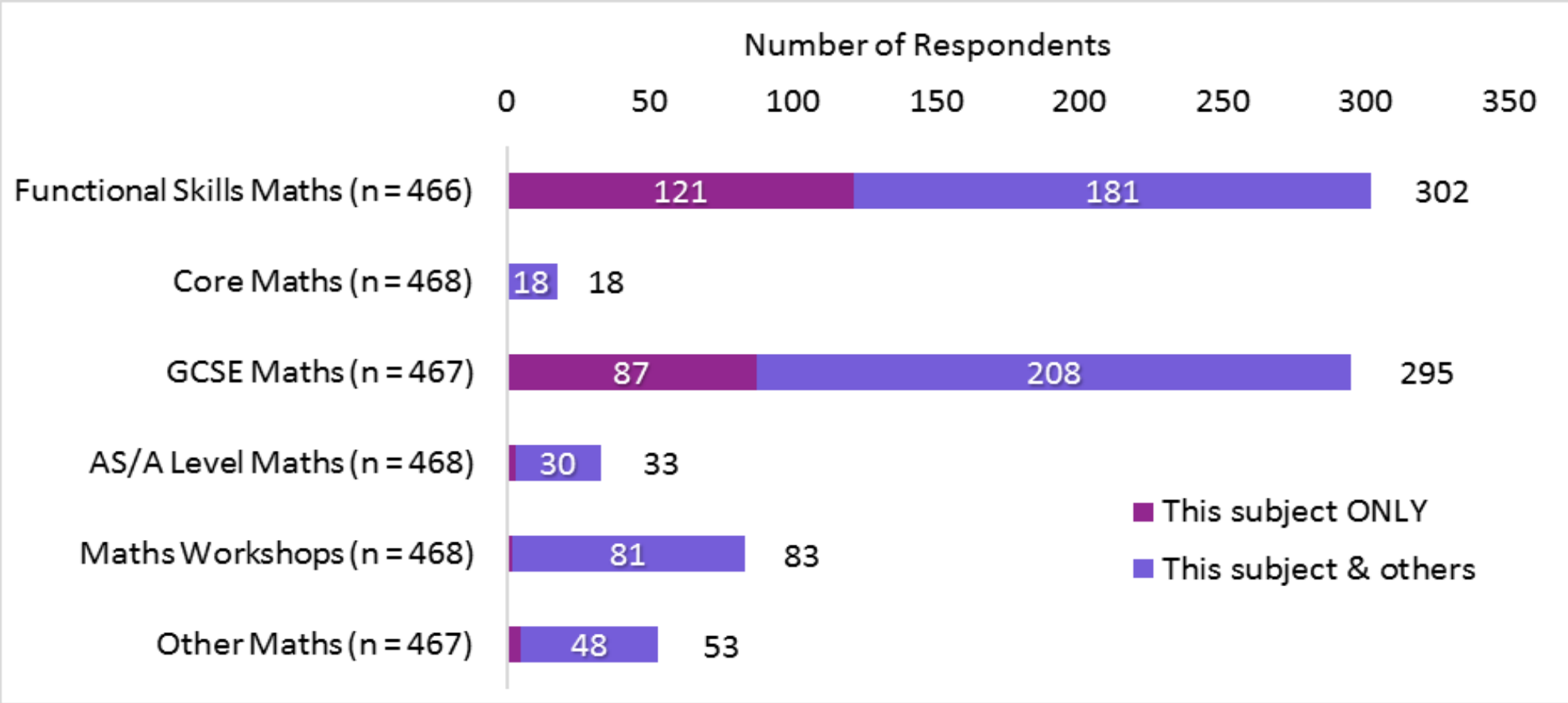
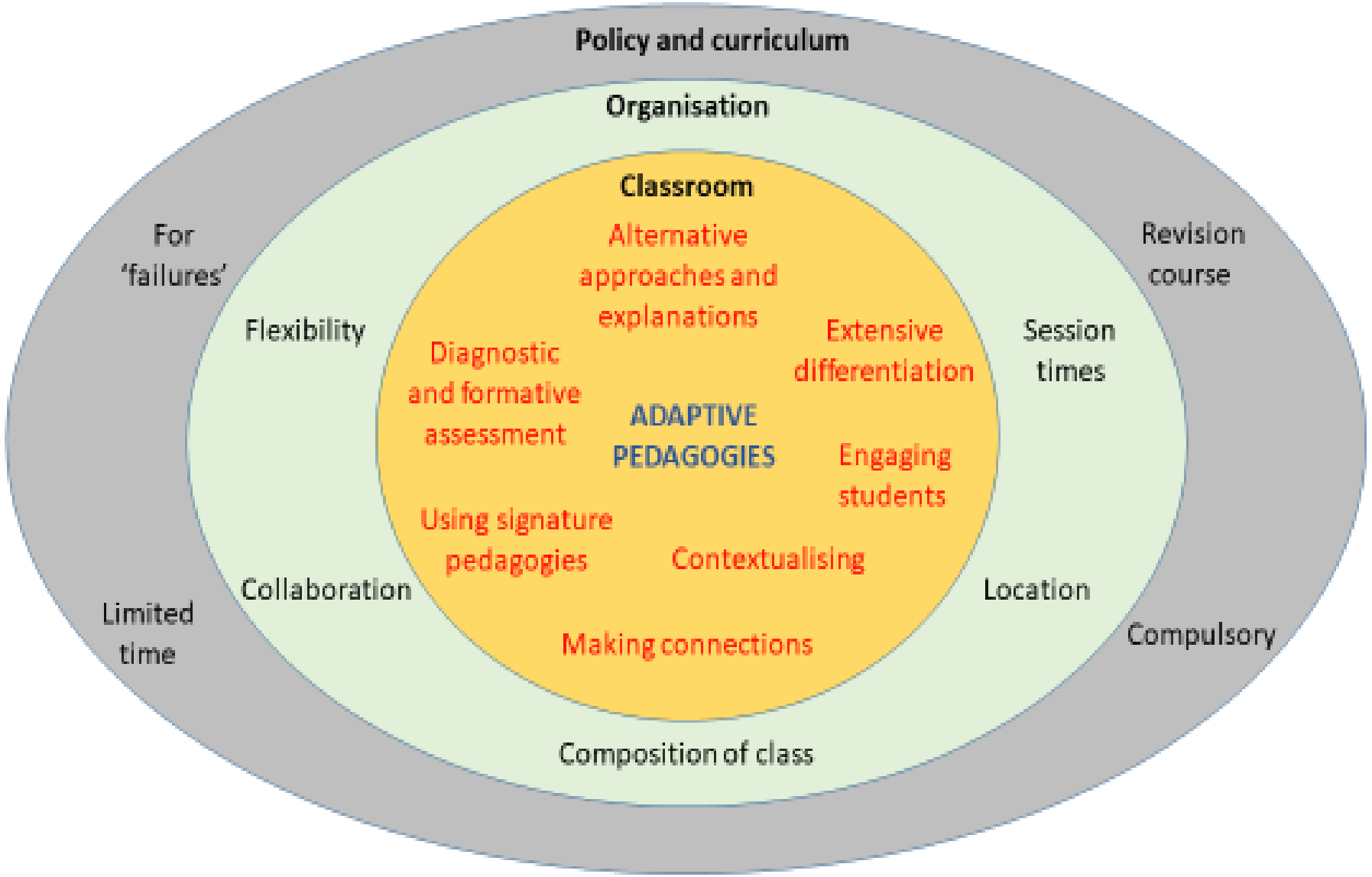


Figure 5: Number of respondents reporting any contact hours for each of the 6 categories of mathematics provision. For each category, this is divided into people who teach only that mathematics subject, and people who teach at least one of the other mathematics subjects as well as the subject stated. The numbers to the right of each bar show the total number of respondents teaching that subject.

Example: GCSE maths teaching in context



Common structural models

Basic model	Variations	No. of colleges
Centralised	Centralised team on one site under one manager	9
	Site-based teams managed by one central manager	4
Dispersed	Teachers based in vocational areas and managed by vocational staff	3
	Teachers based in vocational areas but managed centrally	2
Multi-team	Separate teams for different types of programme (e.g. adults, sixth form, 16-18s) with different managers	8
	Separate teams for different college sites with site managers	6

Findings: public identity

There is no strong **shared professional identity** for mathematics teachers in English Further Education.

Professionalism in English Further Education is contested and fragmented by deregulation and variations in training pathways.

Variations in qualifications and training routes lead to **diverse identities**.

Identities are divided between:

- a **mathematician who teaches**, or
- a **teacher who decides to teach mathematics**.

Findings: local identity

Professional identity, in relation to the way an individual positions themselves within their college community of practice, indicates the influence of:

- previous employment
- skills and qualifications
- recognised (official) roles.

Specialism	Description
Leadership and management	The individual has overall leadership and management responsibility for the team/department.
Special responsibilities	The individual has a specific recognised responsibility within the team/department (e.g. course leader).
Subject specialist	The individual has a degree level qualification in mathematics (which others may not have).
Other specialism	The individual has other specialist expertise such as teaching students with learning difficulties or disabilities.

Findings: personal identity

Personal ‘specialisms’ as a teacher were evident, influenced by personal backgrounds, critical incidents and previous employment.

Background	Identity
Social worker	Specialist in engaging and relating to young people
Teaching assistant	Specialist in finding alternative methods to explain mathematics to students
School mathematics teacher	Subject specialist sharing expert knowledge of mathematics
Probation officer	Specialist in working with ‘difficult’ students and managing challenging behaviour
Vocational teacher	Specialist in understanding FE students
Industry or business expert	Specialist in understanding the links to the workplace.

Conclusions from MiFEC

- A lack of clear direction or regulation of the FE teaching workforce (Fletcher et al. 2015) leads to **contestation** regarding professional identity; colleges develop their own interpretations.
- In this environment it difficult for teachers to engage in essential **sense-making** (Holland 2001; Grootenboer and Ballantyne 2010) and develop a shared professional identity.
- At college level, structural variations influence the communities of practice that form and sometimes add to the **fragmentation** of professional identity.
- The development of stable and effective communities of practice in colleges might allow teachers to gain a clearer **shared identity**.

Why does it matter?

A high level of teacher autonomy in FE means many teachers personally select the teaching approaches they use, based on their beliefs and experience.

Teaching approaches are varied and the experiences students receive are inconsistent across organisations, and the sector.

Reliable evidence of effective pedagogies may be overlooked.

There may be an over-reliance on personal teacher strengths or preferences.

A Whole College Approach

In a Whole College Approach, improving students' mathematics skills becomes a **shared responsibility**, supported by all staff through their **active engagement** in a **collaborative effort**.

Fragmentation → Coordination → Collaboration → Active participation

Key ideas: soft systems thinking and complexity

Complexity

A linear sequence of actions does not capture the complexity of the process required or the human systems involved (Checkland 2000; Monat and Ganon, 2015).

A holistic approach

There is a need to think holistically and reflect on how the separate parts make up the whole (Checkland 2000).

Interactive systems

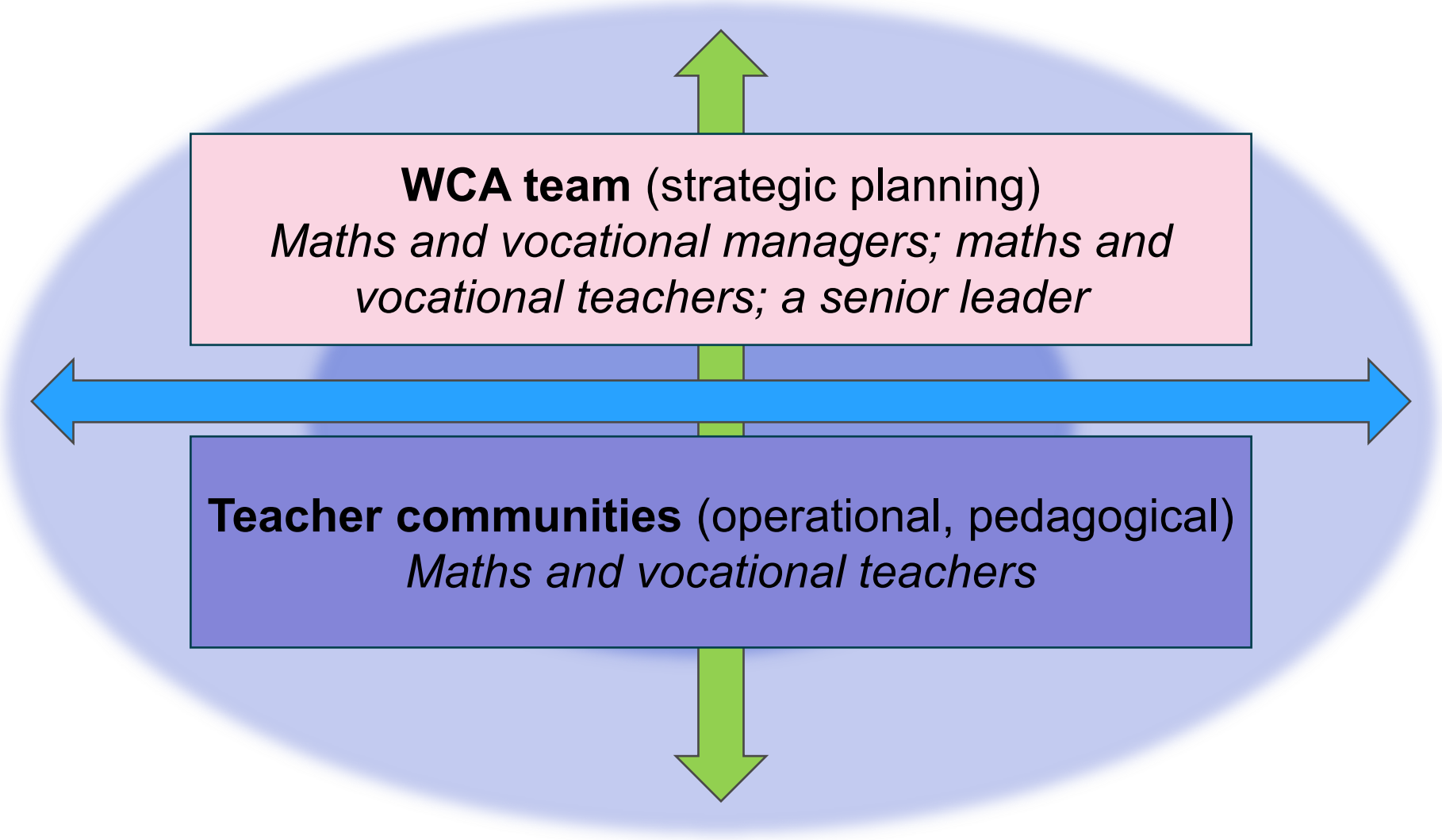
“Interactions are the central dimension of complex human systems” (Hawkins & James, 2018, p.731). People may belong to several systems; they change due to interactions, and new system properties emerge.

Programme summary

Colleges were expected to:

- form an appropriate cross-college **WCA team** to collaborate and lead their intervention;
- explore a self-identified **problem** or area for improvement;
- work with the **self-assessment** tasks, other resources, guidance and feedback provided by their ‘critical friend’ (UoN);
- develop a context-specific **WCA action plan** to address the problem;
- participate in meetings with their external ‘critical friend’ to **review** progress, evaluate impact and develop plans.

WCA interdepartmental communities



Development of communities of practice

New roles and relationships encourage ownership, changes in attitude and in behaviour (Beer, Eisenstat & Spector, 1993).

As new communities of practice developed, teacher identities also began to change (Wenger, 1999).

Teacher identities

Narrative identities

What maths teachers said about themselves in interviews and the way they spoke about themselves in meetings.

Enacted identities

How maths teachers behaved in meetings and what else they did, inside and outside their own classrooms.

Perceived identities

What students (and other staff) said about their maths teachers.

Evidence of changing identities (examples)

Narrative identities

- A shift away from blame culture
- Inclusive language such as “we” instead of “us” and “them”
- Increased interest from maths teachers in understanding vocational perspectives
- A change of intent towards tackling problems collaboratively

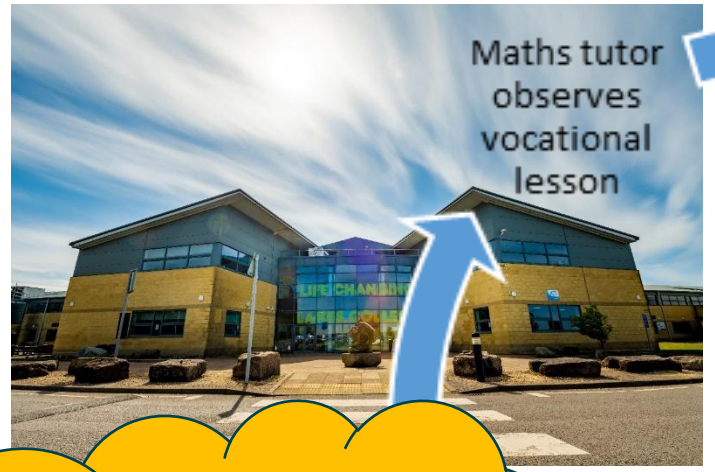
Enacted identities

- Vocational and maths staff mingle instead of sitting in separate groups in meetings
- Maths staff become more frequent visitors to vocational areas of the college
- Maths teachers become comfortable in vocational environments and embraced the opportunities to learn

College A: narrative and enacted identities

Maths and vocational learning – interacting and interweaving

Visiting each other's classrooms opened new opportunities to support each other with the development of students' maths skills. Vocational and maths teachers recognised they were teaching similar mathematics but in different contexts and could link these together.



College B: enacted and perceived identities

Breaking out of the 'silos' – using interdepartmental activities to change students' perceptions of maths, and maths teachers

Staff recognised the need to form new interdepartmental collaborative groups to deal with maths issues. Joint events where students engaged with maths in a different environment helped break down barriers between maths teachers and students.

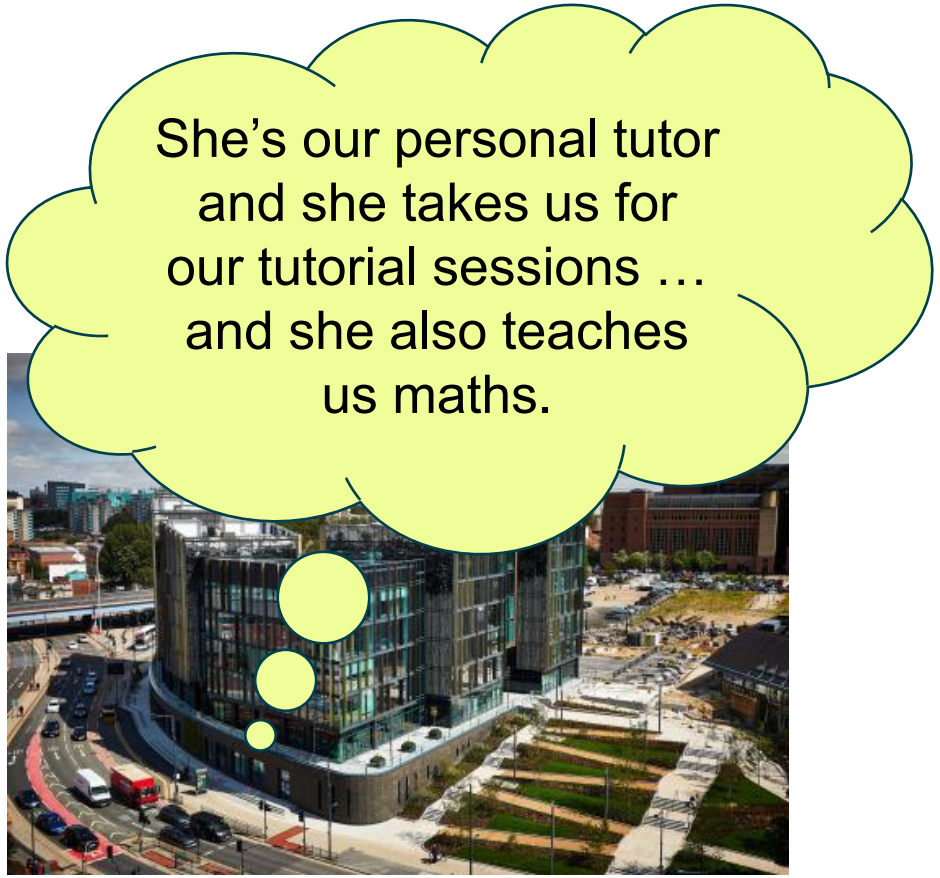
"It was the first time, I've come out of maths buzzing, I can ask … how to do the maths now I know that I'm better than him at darts"
Student participant

"I know some of these students from disciplinaries, it's great to see them so engaged!"
Senior college leader

College C: enacted and perceived identities

Taking the integration of maths teachers a step further than before

- Maths teachers were already positioned within vocational departments but in separate staff rooms.
- Space was first created to talk informally, which led to the development of strategies for further integration.
- These strategies included vocational teachers and maths teachers sharing staff rooms, and some maths teachers undertaking roles in the vocational course, such as becoming a personal tutor to a group of students.



Conclusions from WCA

- In some communities, mathematics specialists became **mathematics teachers in vocational education**
- Maths and vocational teacher identities were shaped by their **participation in interdepartmental communities**
- The **aims and nature** of the community influenced the types of identities that teachers developed

Maths in T levels

- Technical qualifications (T levels), aimed at students aged 16 years and over;
- Phased introduction, with first T levels taught from September 2020;
- Designed to be more ‘academic’ than other vocational or technical programmes;
- Extended time in work placement
- Maths is integrated rather than taught separately.

A competency-based approach to maths

- Students engage with mathematics through applications in **authentic vocational contexts** (Royal Society, 2019).
- Competencies are demonstrated by an **activation of maths** to deal with problems within a given context (Niss & Hojgaard, 2019).
- The mathematics may be no more advanced than students have already learned but the emphasis is on the **application** in work-related situations.

A competency approach (T levels)

The **General Mathematics Competency (GMC) framework** focuses on the development of ten general mathematical competencies:

- Measuring with precision
- Estimating, calculating and error spotting
- Working with proportion
- Using rules and formulae
- Processing data
- Understanding data and risk
- Interpreting and representing with mathematical diagrams
- Communicating using mathematics
- Costing a project
- Optimising work processes

An embedded model

Opportunities to develop maths competencies are **embedded** into the vocational programme.

Vocational teachers are the main **policy actors** with responsibility for maths in T levels.

The research study suggests:

- Almost all maths in T levels is taught by vocational teachers.
- There is little input or guidance from maths teachers.

Approaches to embedding maths

- Variable use of the GMC framework
- Different levels of embedding
- Highly influenced by vocational teachers' own preferences

Highly visible

- **Maths clearly identified but taught in a relevant vocational context**
- **Opportunities to make explicit connections to maths in other contexts**
- **Maths anxiety and negative attitudes more likely to surface**

Deeply embedded

- **Hidden to the point of disappearing**
- **Students unaware that they are doing maths, so maths anxiety and negative attitudes unlikely to be evidenced.**
- **Little opportunity to develop transferable maths skills**
- **Sometimes little actual maths.**

Teacher confidence and competence with maths

Confident and competent teachers were more likely to:

- highlight the maths in their vocational teaching
- make it visible in a range of different contexts
- use a range of approaches

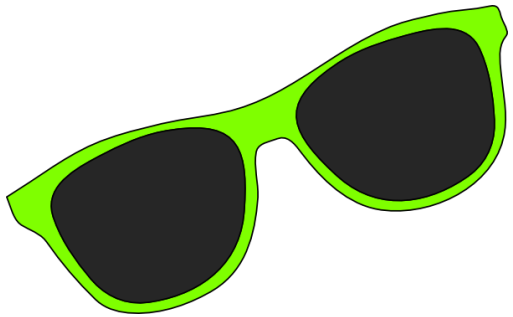
Less confident and competent teachers tended to:

- favour deeply embedded approaches
- avoid identifying when maths was being used
- adopt a procedural approach

Implications for students

Visible maths

The visibility of maths in students' training and workplace means it is seen as an essential component of their work practices, with relevance and value in the workplace.



Deeply embedded maths

The apparent absence of maths from the technical pathway reinforces a view that maths is a subject associated predominantly with the past in school.

Questions

1. Who should teach what maths in FE colleges?

2. What identities do we want maths teachers to develop when teaching in vocational educational settings? What are the benefits and possible disadvantages?

3. What role should vocational teachers take in the development of students' mathematics skills or competencies? What are the potential benefits of greater involvement and the challenges?

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