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A survey of teachers of mathematics in England's Further Education Colleges

The Mathematics in Further Education Colleges Project:
Interim report

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Executive summary

The Smith Review of post-16 mathematics education (2017¹) highlighted the paucity of good data on the Further Education teacher workforce in England. Given the national policy priority of raising the level of mathematical competence throughout education and in the general populace, and the central role that Further Education (FE) plays in realising this ambition, this is a serious shortcoming.

This survey is the most comprehensive evidence of the mathematics teacher workforce in England's Further Education colleges (FEC) at the present time. Key stakeholders need to understand the composition of this workforce and, in particular, how it differs from that of secondary schools. This will enable better strategic design of policy and practice for the recruitment and initial training of suitably-qualified teachers in FE and the ongoing professional development of established teachers of mathematics.

The survey is one strand of the Mathematics in Further Education Colleges (MiFEC) project and is funded by the Nuffield Foundation. The project includes a major ongoing programme of research in colleges so there are no substantive recommendations at this stage. The final MiFEC report (due late summer 2019) will combine the project's strands and include recommendations for a range of stakeholders including national decision makers, college managers, curriculum leaders and CPD providers.

The MiFEC survey was designed to answer two of the project's main questions:

1. Who is teaching post-16 mathematics in Further Education (FE) colleges and what are their roles and responsibilities?
2. What are the training and development needs of these teachers?

In addition, the survey provides rich data relevant to a wider range of issues concerning the FE mathematics teacher workforce at a time of transition.

This MiFEC survey focuses on General Further Education Colleges (GFECs) and does not include Sixth Form Colleges (SFCs) or other FE providers. Hayward and Homer's (2015) survey² included SFCs and only had a small number of mathematics teachers from GFECs across England. The recent Department for Education (DfE) survey conducted in 2018 is general in nature and so cannot answer the mathematics-specific questions above. Similarly, FE workforce reports based on Staff Individualised Record (SIR) data are not sufficiently granular. The data reported here, therefore, offer the clearest and most up-to-date account of the mathematics teacher workforce in FE in England.

The sample for the survey consists of teachers of mathematics qualifications (of any age group or level) from 31 Further Education college providers (i.e. FE colleges or college groups) who agreed to participate in the MiFEC project. This is around one sixth of all such providers in England. The selection of these 31 providers from the 187 GFECs at the commencement of the project (Sept 2017) was designed to provide a balanced sample across the nine regions of England through stratification by region and use of a limited

¹ Smith, A. (2017). Report of Professor Sir Adrian Smith's review of post-16 mathematics. London: Department for Education. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630488/AS_review_report.pdf

² Hayward, G. & Homer, M. S. (2015). Profile of the mathematics teaching workforce in the college sector in England. London: The Gatsby Charitable Foundation.

number of selection criteria: size (number of 16-18s); type of provision (vocational only or academic and vocational); location (e.g. *urban major* or *minor conurbation*); mathematics progress measure and most recent Ofsted grade. Carrying out the survey with this balanced sample of colleges provides opportunities for integrating the case study and survey data. There is also good potential for generalization and data triangulation. The response rate is estimated to be just over 60% based on unofficial workforce data provided by these colleges. The survey was conducted in the summer of 2018 with 480 teacher respondents.

Key findings

The main findings fall into three broad areas: 1) the composition of the mathematics teacher workforce, 2) training and professional development needs, and 3) roles and responsibilities.

Composition of the workforce

The composition of the mathematics teacher workforce in FE colleges is distinctive with respect to teachers' prior experience and entry routes. It is important that decision makers understand this distinctiveness as it has a bearing on recruitment, training and ongoing professional development.

The *backgrounds and prior occupations* of FE mathematics teachers are diverse. Teaching mathematics in FE frequently follows a career change with teachers transitioning from a range of occupations. The most common prior employment for FE mathematics teachers is working in industry, business or self-employment. Other common entry routes involve a transition from vocational (or other subject) FE teaching or from teaching mathematics in schools. Very few are in full-time study immediately prior to teaching mathematics in FE (10%). The range of prior occupations and entry routes differs from the typical route into school mathematics teaching, i.e. as a first career. The FE mathematics teacher workforce broadly consists of those who have entered via three main pathways:

1. those changing career from outside education to teach mathematics in FE (24%);
2. those with experience of teaching in FE who have changed subject or added mathematics as a second subject (19%);
3. those who have taught mathematics elsewhere before moving into FE (23%).

Contractual arrangements (e.g. full-time or part-time) and timetabled teaching for this sample of teachers shows the majority (63%) specialising in mathematics teaching (i.e. teaching mathematics only) but around a quarter (26%) are teaching another subject as well as mathematics. Most of those specialising in mathematics teaching are on full-time contracts. Those teaching another subject as well as mathematics may teach mainly mathematics (10%) or be employed as vocational (or other subject) teachers but teach some mathematics as a second subject (16%). A substantial contribution to the workforce (26%) is made by these teachers who have dual priorities. A staff audit carried out by each college shows slightly less full-time mathematics specialists and slightly more hourly paid teachers than in this sample but the overall contractual profile is similar.

Teaching mathematics in FE is an attractive *career change or progression* for both younger and older people from a range of backgrounds. Teachers enter FE mathematics teaching for a variety of reasons, often based on a personal preference or choice. Common reasons

to teach mathematics in FE include wanting to work with 16-18 year olds (25%) or to move away from teaching in school (17%), as well as having a personal enjoyment of the subject (49%). This diversity is important when considering ways of attracting more mathematics teachers into FE.

There is evidence of some short-term *workforce stability* since the majority of respondents expect to continue in a similar role for the coming year and job satisfaction levels are reasonably good (60% satisfied or very satisfied). The medium to long term prospects are less certain. In three years' time 15% of the current workforce expect to have moved out of FE mathematics teaching and over a fifth are undecided about their future plans, whilst new entrants to the profession have only amounted to 18% of the workforce in the last three years. It is likely that the mathematics teacher shortage in FE will increase unless there is a downturn in demand or significant interventions to boost recruitment.

Training and professional development

There are varied and substantial training and professional development needs within the mathematics teacher workforce that result from the diversity in qualifications and prior experience. These need addressing either within initial or pre-service training or in appropriate professional development pathways for individuals.

Almost all of the respondents have undertaken a *teaching qualification* or are currently in training. Much of the workforce has experience of teaching mathematics and/or teaching in FE but just under half (45%) do not hold a *specific mathematics (or numeracy) teaching qualification*. This highlights the need for developing teachers' subject-specific pedagogy, in particular for those new to FE mathematics teaching or experienced vocational (or other subject) teachers who have made a transition into teaching mathematics.

Teachers have varied levels of *qualifications in mathematics*. Some have undergraduate mathematics degrees (30%) or a Master's degree (7%) whilst others only hold a Level 2 qualification (34%). Some of the FE mathematics teacher workforce are teaching at the same level as their highest qualification in mathematics. Although some teachers have additional non-accredited subject knowledge, there is an outstanding need for subject knowledge enhancement in professional development plans.

Most teachers of mathematics in FE experience very little *mathematics-specific Continuing Professional Development (CPD)* (55% reported 5 hours or less³, one sixth reported 0 hours). The number of hours per year varies widely (19% report over 20 hours), even for those teaching mathematics as their main subject, and there are striking differences between colleges. Whilst teachers in one college report having very few mathematics-specific CPD sessions (e.g. 0-5 hours for 86%), staff in another college report that they attend the equivalent of several days per year (e.g. 80% over 20 hours). Those who teach another subject in conjunction with mathematics are less likely to participate in mathematics-specific CPD, although these teachers may have substantial training needs. Given the priority of increasing post-16 mathematics attainment and the diverse needs of the workforce, the support for mathematics-specific CPD is low.

Teachers value opportunities for *informal professional development*, particularly discussion with colleagues (92% helpful/very helpful). Coaching or mentoring activities are also

³ This and other CPD numbers in this section are for the academic year 2017/18.

considered helpful by around 90% of respondents and they report benefitting more from observing their peers than being observed. The diversity of the teacher workforce provides a rich, and often untapped, resource for this type of informal professional development.

Roles and responsibilities

The roles and responsibilities of mathematics teachers in FE reflect *current priorities in the implementation of post-16 mathematics policy*. There is some specialisation in teaching roles according to the qualifications being taught but, in general, all teachers undertake a range of out-of-class activities including administrative tasks and those directly connected to classroom teaching and support for students.

The majority of mathematics teachers in general FE are teaching *qualifications at Level 2 and below*, reflecting the prioritisation of 16-18 low-attaining students in current policy and the impact of the *condition of funding*. Around two thirds teach GCSE Mathematics (63%) and Functional Skills Mathematics (65%). Some currently specialise in being either a GCSE (25%) or Functional Skills teacher (24%), although another quarter of respondents teach both qualifications (24%). A minority teach A level Mathematics (7%) and Core Maths (4%), usually in conjunction with other mathematics qualifications. A larger minority teach on a range of accredited and non-accredited 'other mathematics' courses (11%).

Out-of-class tasks take up a considerable amount of time for many FE mathematics teachers (c. 12-14 hours). Most time is spent on assessment, planning and preparation but tracking student progress and monitoring attendance also feature strongly. The range of activities carried out shows the importance of things that are directly linked to ensuring *student compliance* with compulsory mathematics policies, for example attendance monitoring (23% report spending 2-5 on this per week).

Most FE mathematics teachers spend some time *liaising with vocational staff*. This is more likely to be about students than about mathematics. Whilst this indicates a high level of interaction concerning student welfare and behaviour, there is less communication about connecting mathematics to vocational learning (69% report 20 minutes or less per week). Most teachers provide *voluntary support for students*, on an individual basis or through a workshop. In some colleges, workshop teaching is part of teachers' contracted teaching hours but in others it is voluntary and additional.

The most common *professional development needs* identified by teachers are connected to issues with a) student engagement, motivation and behaviour and b) subject-specific approaches to teaching. The emphasis on improving student engagement, motivation and behaviour arises from compulsory mathematics policies. Teachers' perceptions of needing to increase their understanding of mathematics-specific pedagogy are consistent with the CPD needs identified above and highlight the importance of an appropriate professional development programme planned to address the specific individual needs of mathematics teachers in FE.

Introduction

The Mathematics in Further Education Colleges (MiFEC) survey is part of a national, mixed-methods research project funded by the Nuffield Foundation that will provide evidence-based advice for policymakers, college managers, curriculum leaders and practitioners on how to improve mathematics education in England's Further Education colleges (FEC). The final project report in the late summer of 2019 will bring the survey and other strands of the project together with a set of clear recommendations for different stakeholders.

The MiFEC survey explores the following questions:

1. Who is teaching post-16 mathematics in Further Education (FE) colleges and what are their roles and responsibilities?
2. What are the training and development needs of these teachers?

In addition, a wider set of questions investigated the impact of national and college policies on 1) curriculum, pedagogy and learner experience, and 2) teachers' work, training and professional development.

The survey did not set out to collect full details of qualifications but to gain understanding of the following five areas:

- **General teacher background:** gender, age group and mode of employment.
- **Teaching experience:** pathways into teaching mathematics in FE colleges; professional experience; previous employment and reasons for becoming a mathematics teacher in FE.
- **Roles and responsibilities:** teaching hours; additional responsibilities and the key elements of daily work.
- **Changes over time:** changes in employment; expected changes in workload and employment; teacher satisfaction.
- **Training and professional development (PD):** teachers' mathematics qualifications, teaching qualifications; professional development; possible skills needs.

There is broad agreement that there has been a national shortage of mathematics teachers for some time⁴ and that this is a particular issue in Further Education⁵. Recent policy changes to the *condition of funding* require students without a GCSE Mathematics grade 4 (previously grade C) to continue their study of mathematics post-16 and for those with grade 3 (previously grade D) to re-sit the GCSE examination rather than taking an alternative mathematics qualification. The majority of these lower-attaining students progress to FE⁶ at age 16 and take mathematics qualifications at Level 2 or below⁷. The

⁴ Kyffin, H., Hodgen, J. & Tomei, A. (2013). *The Supply of Mathematics Teachers in the Further Education Sector*. London: The Gatsby Charitable Foundation.

⁵ Greatbatch, D. & Tate, S. (2018). *Teaching, leadership and governance in Further Education*. London: Department for Education.

⁶ FE Colleges have many more students retaking mathematics than schools have (60% compared to 13%) <https://policyexchange.org.uk/publication/crossing-the-line-improving-success-rates-among-students-retaking-english-and-mathematics-gcses/>.

⁷ Department for Education (2016) *Post-16 Maths participation in 2014/15*. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584872/Ad-hoc_notice_-_Post-16_maths_participation_in_2014-15.pdf

demand for well-qualified mathematics teachers in post-16 education is therefore greater than ever and Professor Sir Adrian Smith's recent treasury-commissioned report (2017) has highlighted the challenges experienced by FE colleges in recruiting suitable staff.

The nature and extent of the mathematics teacher shortage in FE is not well understood due to the paucity of good data. Smith (2017) concludes that "little is known about the workforce teaching mathematics and quantitative skills in FE colleges" and recommends that "The Department for Education should improve the evidence base on the FE workforce teaching mathematics and quantitative skills in order to assess supply, teaching quality and the effectiveness of current recruitment measures". Although the DfE has recently conducted a survey of teachers and managers in colleges, the data is too general to understand the mathematics teacher workforce in sufficient depth.

FE workforce data from Staff Individualised Records (SIR) are collected annually from colleges but returns are not mandatory. SIR reports include general data on age, ethnicity, annual pay, terms of employment, qualifications, CPD and membership of professional bodies for teaching and non-teaching staff, and main subject of teaching. Recent improvements in the return rate led to 91 submissions from General Further Education Colleges (GFECs) in 2018 and the growth in national reporting is valuable. However, these reports do not capture the large number of staff who teach some mathematics in addition to their main subject, nor do they include data about mathematics-specific issues of concern to the FE sector (e.g. mathematics-specific CPD).

An earlier report on the workforce was skeptical of whether SIR data could provide a reliable overview of the mathematics teacher workforce⁸. This report only involved small numbers of teachers, focusing mainly on teacher qualifications and CPD needs. Only 186 respondents taught mathematics or numeracy as their primary teaching activity and only 54% (100) of these worked in General FE colleges. The study involved:

- An overview survey of 40 Sixth Form Centres (SFCs) and 65 GFECs from which the numbers teaching mathematics or numeracy were estimated;
- A face-to-face survey of teachers (who were willing and available at the time of the visit) from a random sample of colleges, stratified by size and region;
- An on-line survey to supplement the face-to-face survey.

The Education and Training Foundation (ETF) analysis⁹ (2014) also focused on teachers' qualifications. It was based upon two surveys, one a Training Needs Analysis of teachers involved in the GCSE Mathematics (157 respondents from FE colleges) and the other a Strategic Consultation Survey of mathematics and English teachers in the college sector (149 respondents). The low numbers of respondents and particular foci makes it difficult to establish a clear picture of the FE mathematics teacher workforce from these studies and, in any event, recent changes have resulted in substantial shifts in the size and shape of this cohort.

There is an outstanding need for better analysis of the FE mathematics teacher workforce; their roles and responsibilities; progression routes into FE teaching; workforce satisfaction;

⁸ Hayward, G. & Homer, M. S. (2015). Profile of the mathematics teaching workforce in the college sector in England. London: The Gatsby Charitable Foundation.

⁹ The Education and Training Foundation (2014). The Qualifications of English and maths teachers. Available at: www.et-foundation.co.uk/wp-content/uploads/2014/09/RPT-Survey-v4.pdf

the likelihood of remaining teaching mathematics in FE; prior training and professional development needs. Such data will inform the development of recruitment strategies, entry routes and appropriate CPD. It is also important to obtain up-to-date information at a time of considerable change for FE colleges which has included the introduction of new mathematics qualifications and a resulting change in workforce composition¹⁰.

The MiFEC survey was completed by staff who were teaching mathematics in the academic year 2017/18 on courses that led to a mathematics qualification. This makes a clear distinction between those teaching stand-alone mathematics qualifications and those teaching mathematics that is embedded within other subjects¹¹.

The survey was undertaken with 31 FE college providers (FE colleges or college groups) who agreed to participate in the MiFEC project. These providers were selected from the 187 GFEC providers at the commencement of the project (Sept 2017) to provide a balanced sample across the nine Government Office Regions of England. The sample was stratified by region and a limited number of other key criteria: size (number of 16-18s); type of provision (vocational only or academic and vocational); location (e.g. urban major or minor conurbation); mathematics progress measure and most recent Ofsted grade. By carrying out the survey with these case study colleges, further information about the context in which staff are teaching mathematics is available. With a balanced sample of colleges, there is also greater potential for generalization and triangulation than previous surveys with small, random samples.

Staff audits were completed by managers in these colleges in order to ascertain the size of the workforce and the staffing profile by type of employment. The employment categories were designed to incorporate appropriate current terminology (e.g. mathematics, not numeracy) and descriptions of the mode of employment for mathematics that would reflect current work patterns (e.g. full-time teaching mathematics only, teacher teaching some mathematics, etc.) rather than general employment types. This has produced an informed overview of the mathematics teaching workforce and enables a better understanding of bias in the responses. A comparison of the profile of survey respondents to college staffing audits can be found in the Appendix.

The survey was carried out in June/July 2018. Colleges were able to choose between an electronic or paper version of the survey. Eight colleges requested the paper version. A total of 480 responses and an estimated overall response rate of just over 60% was achieved.

The report shows how the mathematics teacher workforce in FE colleges differs in important ways from that in secondary schools. In particular, the composition of the workforce is distinctive with respect to teachers' prior experience and entry routes, with many teachers choosing mathematics teaching in Further Education colleges as a second or later career. Wide variation in the entry routes, backgrounds and prior qualifications of these teachers is reported, which has significant implications for future teacher recruitment, initial training and continuing professional development.

¹⁰ Association of Colleges (2016). English and maths survey. Available at https://www.aoc.co.uk/sites/default/files/English%20and%20maths%20survey%202016%20-%20summary%20report%20Sept%202016_0.pdf

¹¹ This is explored through the case study strand of the MiFEC project.

The report also provides evidence of the effects of the *condition of funding* on the roles and responsibilities of mathematics teachers in FE colleges as well as the profile of the workforce and the work that they are doing. It is important that stakeholders understand the composition of this group of teachers and the work they carry out in order to enable better strategic design of mathematics policy and practice in FE colleges.

This report presents a comprehensive view of the current mathematics teacher workforce in Further Education colleges. The findings highlight key areas for the attention of stakeholders in the drive for improvement in mathematics provision and important evidence to inform future policy in Further Education.

Section 1: Characteristics of mathematics teachers in FE

Gender

Respondents were asked to indicate their gender by selecting one of four options: 'Male', 'Female', 'Neither of these' and 'Prefer not to answer'. *Figure 1* shows more female respondents (53%) than male (40%)¹². This is consistent with the proportion of females reported by Hayward and Homer¹³ in 2015 for mathematics and numeracy teachers in GFECs but is slightly lower than that of the overall FE teaching workforce (54% female) according to the most recent data from the Staff Individualised Record (SIR)¹⁴.

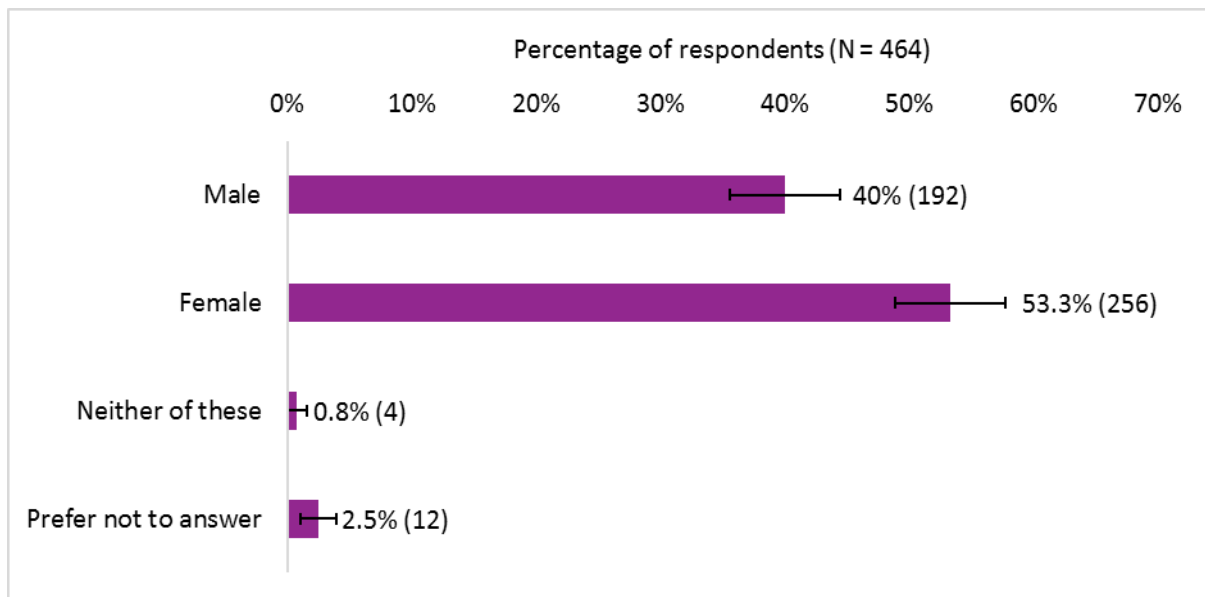


Figure 1: Percentage (and number) of respondents identifying as each gender. Error bars show the 95% confidence intervals for the percentages.

Age

Respondents were asked to indicate their age by selecting one of ten age groups ranging from 'Under 25' to 'Over 65'. *Figure 2* shows the distribution of respondents across age groups. There is some indication that the distribution might be bi-modal, with one group of respondents centred around 35–39 years, and a second group centred around 50–54 years; this is not an unreasonable finding given the pathways into FE teaching discussed later in the report. These two different groups may have entered mathematics teaching in

¹² In the report, most figures show percentages of respondents, with frequencies added to the data labels for transparency. However, some of the stacked bar charts show frequencies because it is potentially unclear whether a percentage on one section of a bar is referring to the percentage of the bar, or the percentage of the entire sample. In these cases, the percentages of the sample represented by each bar are given to the right of each bar, and the figure captions reflect this.

¹³ Hayward, G. & Homer, M. S. (2015). Profile of the mathematics teaching workforce in the college sector in England. London: The Gatsby Charitable Foundation.

¹⁴ The Education and Training Foundation (2018) Further Education Workforce Data for England: Analysis of the 2016–2017 Staff Individualised Record (SIR) data. Available at <https://www.etf-foundation.co.uk/wp-content/uploads/2018/03/Staff-Individualised-Records-Data-Report-SIR-25-2016-17.pdf>

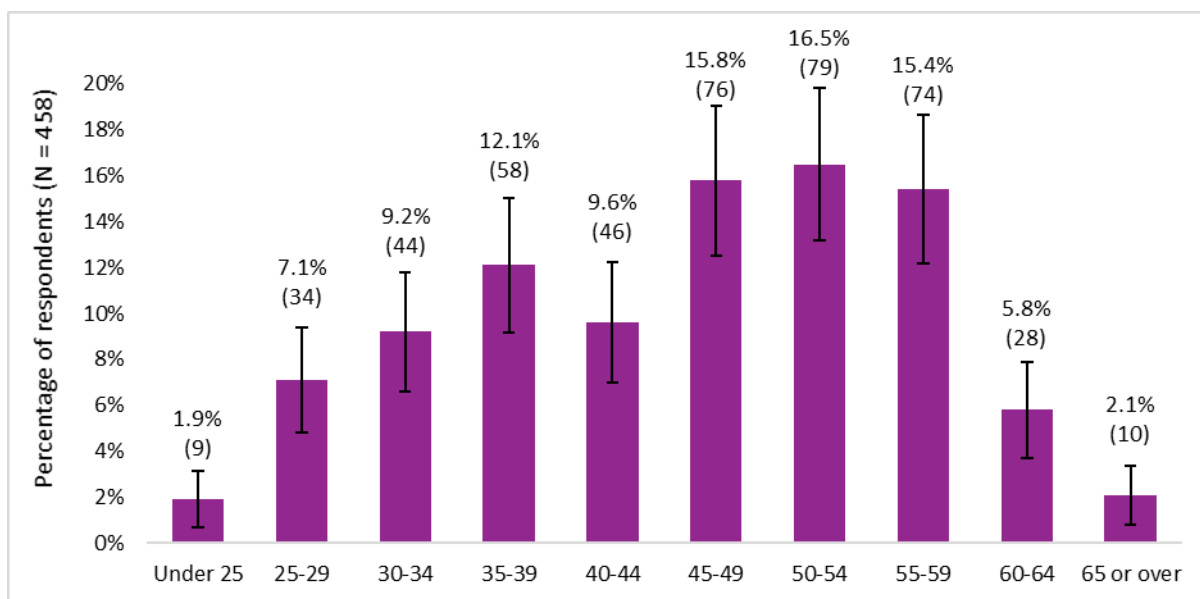


Figure 2: Percentage (and number) of respondents in each of the ten age groups displayed in the survey. Error bars indicate the 95% confidence intervals for the percentages.

FE at different ages, with contrasting prior experiences and training needs. Differences between responses for these two groups (Under 45 years; 45 years and over) have been examined in the following analyses and are reported when clear differences can be seen.

Terms of employment

Teachers were asked to categorise their main employment at their college in terms of whether they were full-time, part-time, or working on a casual basis, and whether or not mathematics teaching was the main component of their employment. Figure 3 shows the frequency and percentage of respondents that fall into each of the nine categories

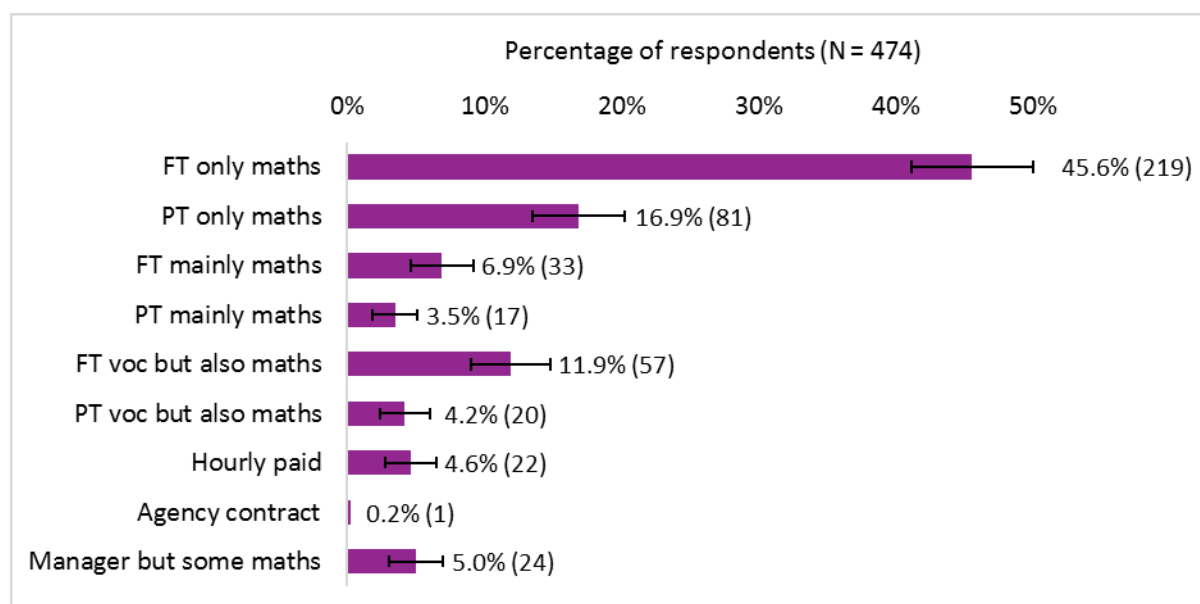


Figure 3: Percentage (and number) of respondents in each of the nine employment categories displayed in the survey. Error bars show the 95% confidence intervals of the percentages.

provided. (A comparison of these data with those from the staff audit and a discussion of the representativeness of the survey sample can be found in the Appendix).

Just over half of the respondents (53%) are mathematics 'specialists' (i.e. staff who only teach mathematics). Most of the rest of the workforce consists of either vocational (or other subject) staff who are teaching mathematics as part of their workload (16%) or others who teach mainly mathematics but also another subject (10%). The dominance of full-time or part-time staff who are teaching mathematics only (in both staff audits and survey responses) is in line with trends indicated in earlier reports¹⁵ resulting from the *condition of funding*. The greater demands on colleges to recruit more mathematics teachers in a time of shortage, many of whom are required to teach GCSE, may be leading to more appointments of mathematics 'specialists' and ensuring those capable of teaching at this level are fully utilised for mathematics rather than teaching other subjects.

The contribution from those teaching mainly mathematics but in conjunction with an additional subject (or subjects) is an important factor. There may be some cross-subject gains in teaching expertise from this mixed role but dual subject priorities are likely to affect attendance at team meetings and CPD. Similar tensions will also arise for vocational (or other subject) staff who are teaching some mathematics, although there may, in this case, be additional benefits in terms of understanding the vocational context.

The staff audit (see appendix) and survey sample both show only a relatively small reliance on agency and hourly paid staff, which is surprising considering the staff shortage. This level of temporary staffing allows for some flexibility in order to respond to variations in student numbers (which are determined by recruitment to the main study programmes) but shows that most colleges are investing in permanent staffing for mathematics. This may be a result of greater stability in the number of students needing to continue with mathematics since the condition of funding, and the need to offer more attractive employment opportunities (e.g. permanent contracts) in order to recruit teachers.

¹⁵ Association of Colleges (2016). English and maths survey. Available at https://www.aoc.co.uk/sites/default/files/English%20and%20maths%20survey%202016%20-%20summary%20report%20Sept%202016_0.pdf

Section 2: Teaching responsibilities

Mathematics contact hours

Teachers were asked to state both their total contact hours per week and their contact hours spent teaching mathematics. *Figure 4* shows a summary of mathematics contact hours as a percentage of total contact hours for each of the nine employment categories.

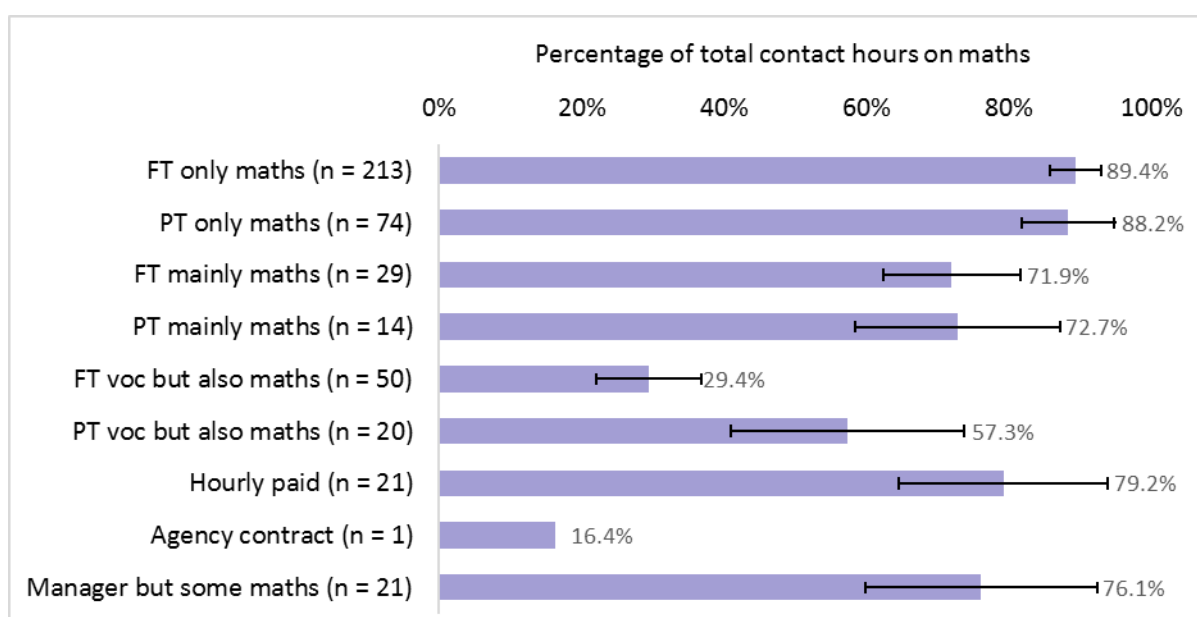


Figure 4: Mean percentage of total contact hours spent teaching mathematics for respondents in each of the nine employment categories. Respondents were asked to input exact numbers for their total contact hours and their mathematics contact hours. These numbers were used to calculate a percentage for each respondent. Means were then calculated across the respondents in each employment category. Error bars indicate the 95% confidence intervals for the means. There is no error bar for Agency contract because there was only one respondent in this category.

Unsurprisingly, teachers employed full-time or part-time to teach only mathematics spent almost all of their contact hours on mathematics teaching (89% and 88%, respectively). Note that it was not an intention in this survey to capture the varied types and quantities of 'remission' (i.e. reductions on actual class contact time) that teachers may be allowed for additional responsibilities (e.g. classroom observations, mentoring, being lead tutor for a course) but this is a common practice in colleges. These allowances, plus any under-utilisation, would account for the average hours teaching mathematics to fall below 100% of contracted class contact hours.

Full-time and part-time teachers who reported teaching mainly mathematics spent, respectively, 72% and 73% of their time teaching mathematics. This is a high percentage of class contact time for teachers with dual subject responsibilities and may well be indicative of a prioritisation of mathematics in some colleges for those who are considered capable of teaching the subject, in order to meet increased demand since the condition of funding.

There was a greater difference between the full-time and part-time vocational (or other subject) teachers who reported teaching some mathematics, with the full-time vocational

(or other subject) teachers reporting 29% of their contact hours being spent on mathematics, compared to 54% for the part-time vocational (or other subject) teachers. These results indicate that some vocational (or other subject) teachers are actually spending more time teaching mathematics than they spend in their vocational or other subject classes. This shows the impact of one of the strategies in use by colleges to recruit sufficient mathematics teachers through 'grow your own' schemes, whereby teachers of other subjects are re-trained to teach mathematics. This group of teachers have specific training and professional development needs. These are not the same as those entering mathematics teaching as graduates, for example, and can vary between individuals, depending on their original specialism and qualifications.

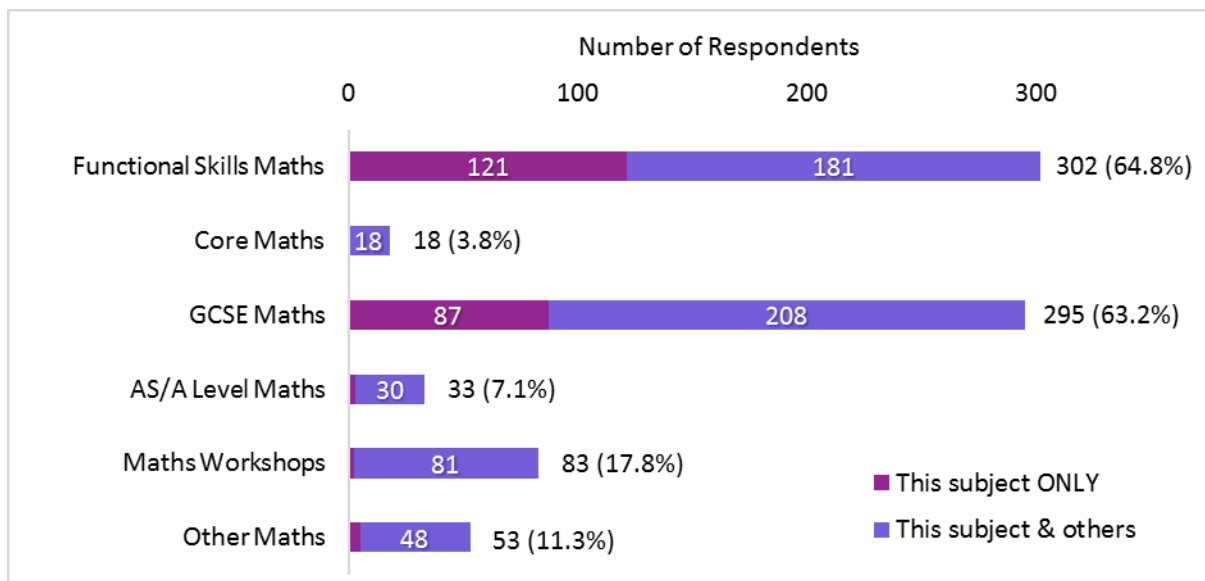


Figure 5: Number of respondents reporting any contact hours for each of the six categories of mathematics provision. For each category, this is divided into people who teach only that mathematics subject, and people who teach at least one of the other mathematics subjects as well as the subject stated.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

Number of teachers by subject

Teachers were also asked to state the number of contact hours they spent on each of the six categories of mathematics provision: Functional Skills Mathematics, Core Maths, GCSE Mathematics, AS/A Level Mathematics, Mathematics Workshops, and Other Mathematics. Figure 5 shows the number of teachers who reported any contact hours for each of these six categories.

Functional Skills Mathematics (65%) and GCSE Mathematics (63%) have the greatest numbers of teachers, which reflects the growth of provision at Level 2 and below since the introduction of the *condition of funding*. It should be noted that these figures show the number of staff teaching on these courses and are not therefore directly connected to the size of the provision, either in terms of the number of classes or the time allocation. They do however show that Functional Skills Mathematics (FSM) features strongly in post-16 FE mathematics provision, despite the prioritisation of GCSE re-sits for 16-18 year olds and the shorter lesson time often allocated to Functional Skills classes.

The number of staff teaching A level (7%) and Core Maths (4%) qualifications is very small compared to those teaching GCSE and Functional Skills Mathematics. Again, a direct connection to the size of provision is not appropriate but these large differences in staffing highlight the relatively small significance of these qualifications in post-16 FE mathematics provision compared to GCSE and Functional Skills Mathematics.

A substantial proportion of staff (18%, which is more than the number who teach A level mathematics), also work in mathematics workshops as part of their contracted hours. These workshops may be a compulsory planned part of the students' study programme or an additional optional activity for targeted further support. Whilst the latter may be an effective strategy to provide additional individual support for students, it does have cost implications for colleges. In contrast, data from a later section of the survey (Section 5, Figure 30) show that some teachers provide workshop support for students on a voluntary basis and that practice with respect to paid or unpaid workshop staffing varies between colleges. This results in some inequity for teachers from different colleges in their conditions of service. The use of workshops also has implications for professional development since individualised workshop-style support requires different pedagogic approaches to whole-class teaching.

The number also teaching 'Other mathematics' (11%) is small compared to GCSE and Functional Skills Mathematics, but is slightly more than the number who teach A level in these GFECs. Within the category of 'Other mathematics', respondents stated a range of non-accredited and accredited courses (e.g. Access Mathematics, Free Standing Mathematics Qualifications, Pre-GCSE Mathematics, GCSE Statistics) and modules within other study programmes (e.g. Analytical Methods for Engineers, mathematics modules for motor vehicle students). The current offers of external support and CPD tend to focus on teaching mathematics qualifications and, to some extent, developing embedded approaches to highlight and/or maximise the opportunities for students to develop mathematics skills in vocational sessions or other subjects. This group of 'Other mathematics' is an area that seems to receive far less attention but includes sessions with different content and purpose to the main mathematics qualifications and so may require different teaching approaches. Although teachers of 'Other mathematics' were not included specifically in the target group for this survey, these results highlight the amount of 'other' provision for which mathematics teachers are needed. This is easily overlooked in assessments of the staffing resources required by colleges and training needs.

The numbers of staff teaching GCSE Mathematics only, or Functional Skills Mathematics only, show that a large section of the FE mathematics teacher workforce consists of 'specialist' teachers of only one qualification. Two main types of 'specialist' teacher are employed, with a distinction being made between GCSE and Functional Skills Mathematics teachers. Notably, almost all A level teachers (91%) and all of those teaching Core Maths are teaching at least one other mathematics qualification.

Number of mathematics qualifications taught

Figure 6 shows the numbers of different qualifications taught by the survey respondents. This indicates the extent of specialisation, in terms of teaching a single qualification rather than a combination of mathematics qualification courses.

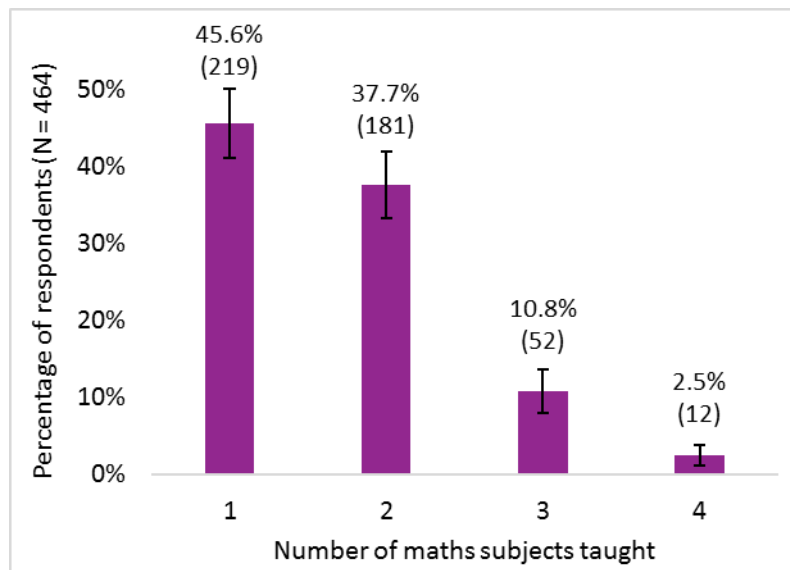


Figure 6: Percentage (and number) of respondents teaching 1, 2, 3 or 4 mathematics qualifications. Respondents were considered to be teaching a particular qualification if they reported any contact hours for that qualification. Error bars show 95% confidence intervals for the percentages.

Overall, these data show how the most common model is to employ staff to teach two or more mathematics qualifications (51%) but there are also substantial numbers of 'specialists' (46%) who only teach one mathematics qualification. Whether such a level of specialisation leads to more effective teaching and is an attractive role is unclear. Both outcomes are however important in order to maintain a stable workforce and high quality teaching. Specialisation may require staff to teach the same lesson multiple times during a week to different classes. This is repetitive, but can reduce preparation time and provide more opportunities for teachers to reflect, modify and improve. Teaching several different qualifications to a similar number of classes in a week may increase the preparation time needed but the added variety (in the level of mathematics taught and the student cohort) may be more attractive and satisfying for some teachers.

When considering the relative workloads of specialist teachers and those teaching multiple qualifications, it is also worth noting variations in the time allocated for teaching different qualifications. GCSE mathematics is typically timetabled for 3 hours a week whilst functional skills classes are often shorter. It would therefore not be uncommon for one full-time GCSE teacher to be teaching 7 or 8 different student groups in one week but this can increase further for a specialist functional skills teacher. A combination of the range of qualifications taught and number of student groups may give a better indication of the impact of specialisation on teachers' workloads and professional satisfaction.

Combinations of qualifications taught

The most common combinations of qualifications taught can be seen in *Figure 7*. These data provide an overview of the mathematics teaching workforce in terms of the most common specialisms and combinations of qualifications being taught.

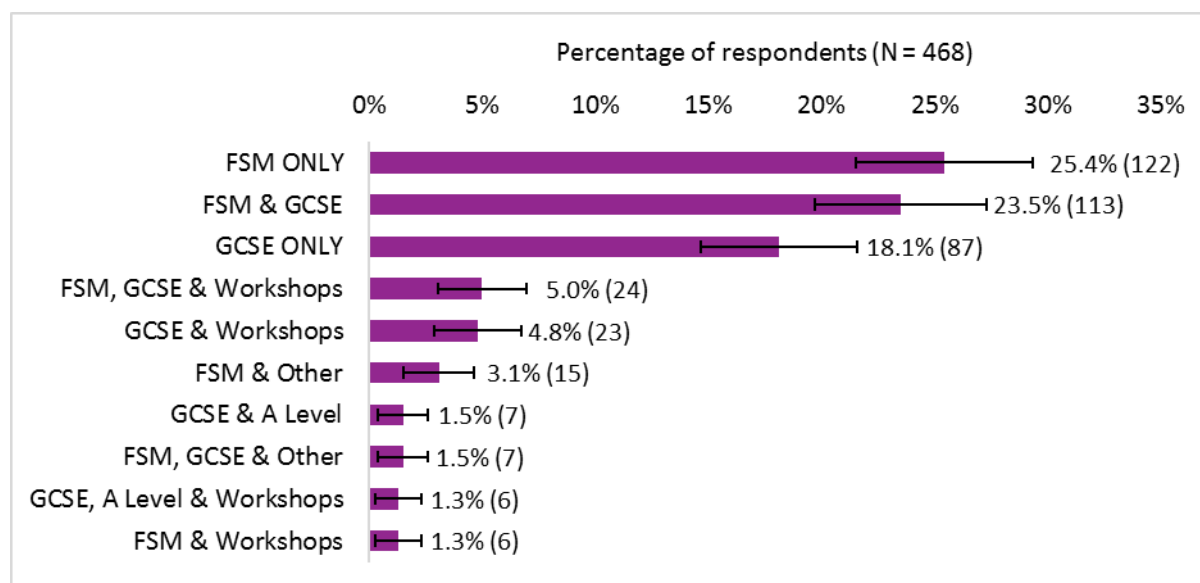


Figure 7: Most common permutations of mathematics qualifications taught. The graph shows the percentage of respondents reporting each of the ten most frequent combinations. 410 of the 468 respondents with data for this question (88%) are represented in these top ten combinations. Error bars show 95% confidence intervals for the percentages.

Functional Skills Mathematics features strongly in this analysis with a large proportion of 'specialist' teachers (25%) and many teaching this in combination with GCSE (24%). The number of 'specialist' GCSE teachers is also high (18%).

Teaching some of these combinations of qualifications may require adaptability in the approaches used due to different emphases in the curricula. For example, teaching approaches for Functional Skills Mathematics, which focuses on application in 'real life' contexts, may vary from those most suited to GCSE Mathematics, which has a more knowledge-based, academic focus. Similarly, as stated earlier, teaching in workshops requires different skills from class teaching. There is typically a more diagnostic and individualised approach in this learning environment. Staff who teach combinations of mathematics qualifications need a wide and flexible range of teaching approaches to ensure they can adapt appropriately to these changes in qualification focus and learning environment.

Mathematics contact hours by subject

Figure 8 shows the mean percentage of mathematics contact hours spent on each of the six mathematics categories for the people who reported any teaching for that subject. The percentage was calculated for each respondent using the sum of the contact hours across the six categories.

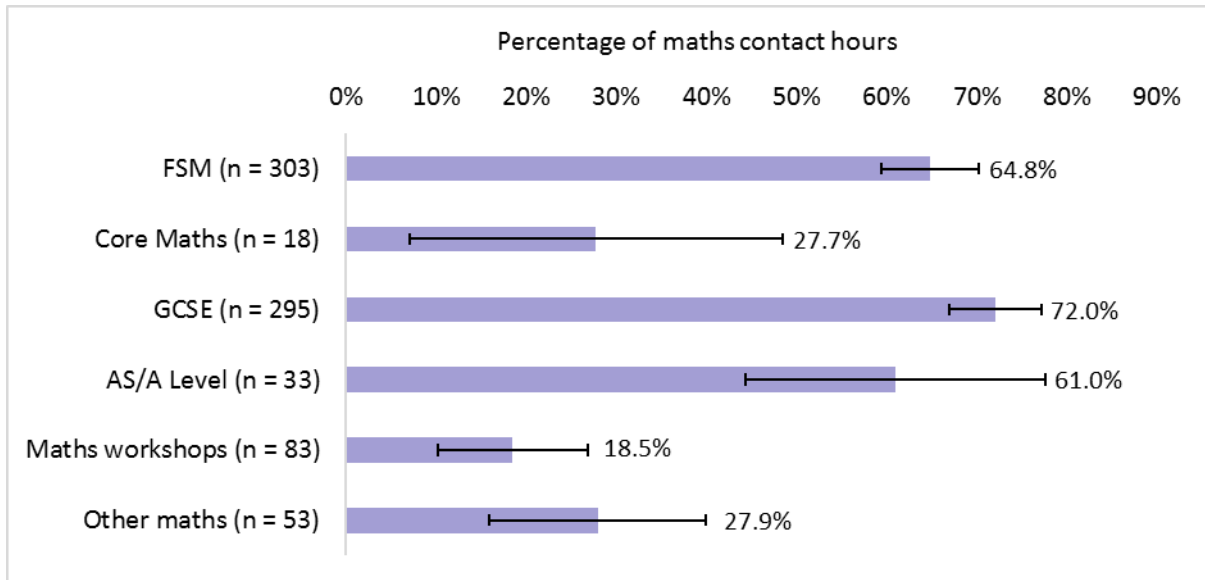


Figure 8: Mean percentage of maths contact hours spent on each subject by people who teach that subject. Only people who reported some contact hours for a subject were included in the percentage for that subject. Error bars indicate the 95% confidence interval.

The percentage of hours spent teaching the separate subjects highlights the dominance of GCSE (72%), Functional Skills Mathematics (65%) and A level (61%) in individual staff timetables for those who teach these subjects. Mathematics workshops (19%), Core Maths (28%) and other mathematics (28%) take the place of secondary subjects with a lower percentage of teaching hours allocated on average. Notably, those who teach 'Other mathematics' spend a similar percentage of their time teaching these courses to that spent by teachers on Core Maths (28%) and this is more than the percentage spent in mathematics workshops (19%). This reinforces earlier findings that 'Other mathematics' is very much a part of FE mathematics provision and should not be overlooked when assessing training and development needs.

Section 3: Qualifications, training and experience

Previous main employment

To better understand the entry routes into teaching mathematics in FE colleges, respondents were asked to select their main occupation immediately prior to teaching mathematics in FE. After an examination of the free text responses for the category 'Other', there was some redistribution of responses into existing categories and two additional categories of interest were identified. These categories were 'Teaching another subject elsewhere' and 'Learning support'. *Figure 9* shows the distribution of respondents over the original and additional categories.

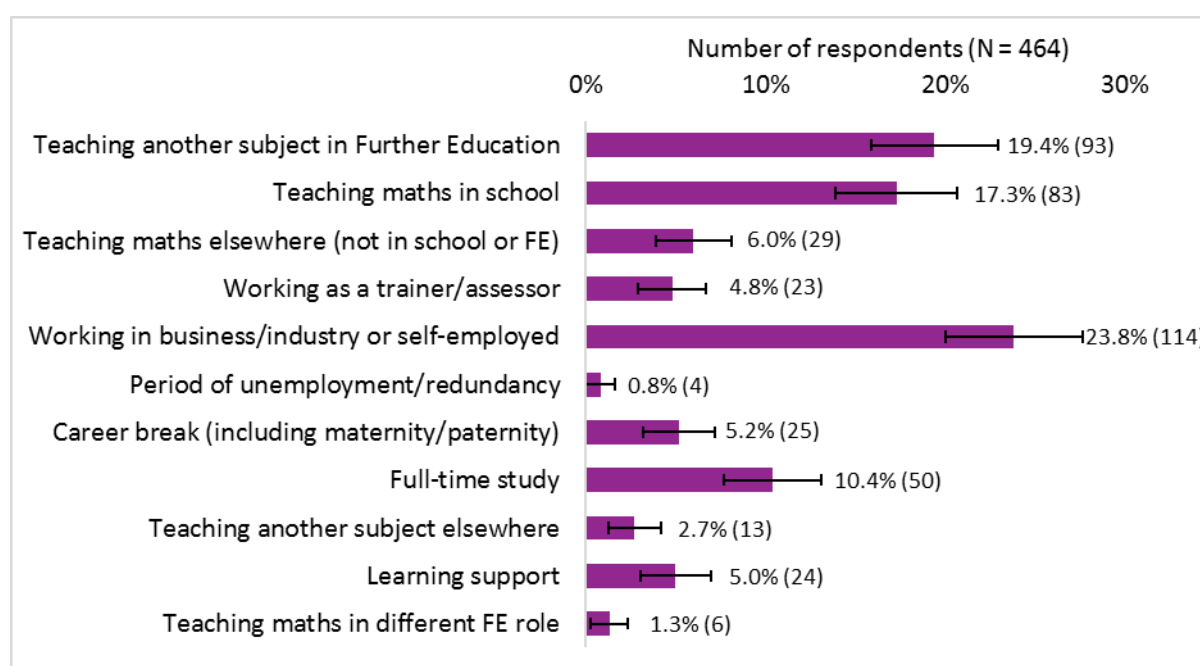


Figure 9: The percentage of respondents who selected each option for their previous main employment. Error bars show 95% confidence intervals for the percentages.

The spread of responses across these categories reflects the diversity of entry routes into FE mathematics teaching. This is not unexpected¹⁶ but highlights the need for training targeted at the differing requirements of these groups of teachers.

The category selected by the greatest number of respondents was 'Working in business/industry or self-employed' showing that about almost a quarter of mathematics teachers in FE (24%) enter the profession from outside education. This constitutes a significant career change. It is consistent with the common practice in FE of vocational specialists entering FE teaching after a career in their chosen trade or vocational profession, except that for vocational teachers this involves a transition from using specialised skills in the workplace to teaching many of the same skills to prepare others

¹⁶ Dalby, D. (2017). The professional identity of mathematics teachers in Further Education. *Adults Learning Mathematics*, 12(1), 7-16.

http://www.alm-online.net/wp-content/uploads/2017/10/almij_121_october2017.pdf#page=7

for similar work. For mathematics teachers, this career change is more substantial. Previous experiences in the workplace might include using and applying mathematics but within a limited context and range. Teaching GCSE mathematics, for example, may require a much wider range of mathematics content and a more knowledge-based view of the subject rather than an applied perspective. The transitions for mathematics teachers undertaking this type of career change will involve substantial training needs in the areas of general pedagogy, mathematics-specific pedagogy and updating (or refreshing) subject knowledge.

It is worth noting that this category includes 28% of the older age group (45 years and over) but only 19% of the younger one (Under 45 years), which indicates some variation in teachers' backgrounds by age. This lower level of prior experience may be due to a small number of the lower age group entering mathematics teaching as a first career, either directly into FE teaching as their first employment or after a first appointment in schools.

Some respondents began teaching mathematics in FE after teaching mathematics in school (17%) or after teaching another subject in FE (19%). This indicates the amount of internal movement of staff in FE from other subjects to mathematics and the transfer of mathematics teachers to FE from school. Considering the general pay differential between school and FE, it is notable that FE is an attractive option for some mathematics teachers in schools. Enhanced pay schemes for mathematics teachers in some FE colleges may well be making the transfer from school to FE more viable as a career progression.

Together, these two categories make up just over 36% of the responses, showing how a substantial proportion of FE mathematics teachers have a teaching background but have moved from other subjects or settings. These teachers may have well-developed general pedagogies and experience but their transition to a different subject or learning environment requires adjustments to their established teaching approaches. For example, subject change may require development of subject specific pedagogy and subject knowledge, whilst teaching in a different learning environment may demand adaptations to established approaches to suit the educational context and student cohort. In both cases, specific training and CPD may be needed for teachers to make a successful transition. The professional development required for such transitions is also worth considering in the light of the skills and responsibilities stated by FE mathematics teachers as being important to their roles later in this section (Section 3) and their 'other' responsibilities (Section 5). It cannot be assumed that good teachers of other subjects or those who are effective in one environment can necessarily make these transitions without further training, CPD and support.

'Learning support' emerges as a prior occupation for a small minority of respondents (5%). This adds yet another career pathway to the diverse set of routes into FE mathematics teaching and is a significant addition since it represents a career progression rather than more substantial change of direction. Together with those entering FE mathematics teaching after a career break (5%) and from business/industry or self-employment (24%), this shows a substantial number of respondents (34%) who see teaching mathematics in FE an attractive career change, or useful career progression.

Only 10% of respondents were in full-time study immediately prior to teaching mathematics in FE. This group included 19% of the younger age group (Under 45 years), compared to less than 5% of the older group (45 years and over). Mathematics teaching

in FE is being considered by some younger people as an early or mid-career option after full-time study, although not necessarily as their first career.

The low overall numbers in full-time study immediately prior to teaching mathematics in FE may reflect the current situation in which a teaching qualification is not mandatory for FE teaching but show a stark contrast to the traditional route into mathematics teaching as a first career. The level of engagement in full-time study prior to teaching indicates that many FE mathematics teachers do not undertake full-time pre-service training and either rely on part-time training courses or enter the profession without prior training.

This analysis indicates the need for in-service training and professional development within colleges if mathematics teachers are to be adequately equipped. This training and professional development also has to meet diverse needs, due to the varied prior occupations of FE mathematics teachers. The main areas of need can be divided into the categories below, according to the three main pathways:

- Significant career change from a non-teaching role outside education (general pedagogy, subject-specific pedagogy and subject knowledge).
- Subject change (subject-specific pedagogy, subject knowledge).
- Change in learning environment (adaptations to pedagogy to suit educational phase, institution and student cohort)

In a time of shortage it is important to draw on all available pathways. These results highlight the importance of decision makers having a good understanding of the different target audiences for recruitment and the associated initial and continuing training needs of these groups.

Reasons for teaching mathematics in an FE college

Teachers were asked to indicate their main reason(s) for starting teaching mathematics in an FE college. The responses, shown in *Figure 10*, were spread across the categories provided and also included a large group with 'other' reasons (15%). The wide range of reasons given for entering FE mathematics teaching is consistent with the diversity in teachers' prior occupations, as indicated in the previous sub-section.

Although the results show the most popular category as 'I enjoy mathematics' (49%), this also means that half the respondents did not see this as a reason for teaching mathematics in FE. This is somewhat contrary to the popular view that mathematics teachers teach because they themselves enjoy the subject; it suggests that a different type of teacher is attracted to working in FE. Of those who reported enjoyment of mathematics as a reason, there is some connection to their level of qualification in mathematics, since the majority of this group (54%) had either a degree or masters in mathematics or had studied mathematics modules in higher education. However, of those who included enjoyment of mathematics as a reason, a substantial proportion (27%) had no higher mathematics qualification than GCSE.

'Wanting a career change' (26%) was the next most frequent reason, which further supports the discussion in the previous section about career choices, based on prior occupation. The number of respondents who indicated that they entered FE mathematics teaching because they wanted a change of career reinforces earlier indications that this

was a positive and attractive second career choice for some people, despite on-going negative messages about general pay and conditions in FE¹⁷.

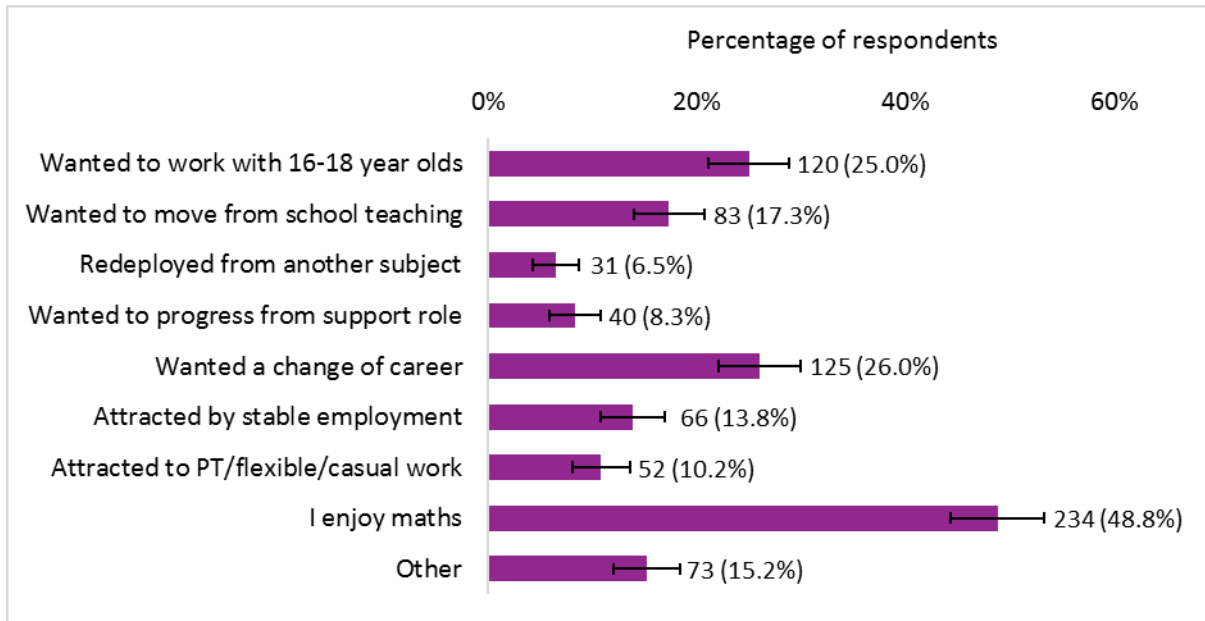


Figure 10: Reasons for starting to teach mathematics in an FE college. Respondents could select more than one reason if applicable and the graph shows the percentage (and number) of respondents who selected each option. Error bars show the 95% confidence interval for the percentage.

Other responses showed that choices were often made on the basis of personal preferences about the working environment such as wanting to work with 16-18 year olds (25%) or wanting to move from teaching mathematics in school (17%). An examination of the additional reasons selected by those who indicated that they wanted a career change showed, however, that 21% of this group also selected the reason of wanting to work with 16-18 year olds. Only 1% of this group said they wanted to move from school teaching and 42% gave neither of the above as an additional reason for their career change. The attraction of teaching mathematics in FE is clearly connected to reasons other than wanting to work with 16-18 years olds or wanting to move from school, although these are important as independent reasons.

Other reasons for starting to teach mathematics in FE were more pragmatic, such as the attraction of stable employment (14%) or part-time/flexible/casual work (10%). Since the majority of the respondents were on permanent fixed contracts, it is likely that most of the latter category would be interested in part-time work, rather than seeking non-permanent positions (e.g. casual work). Within the reasons stated under 'Other' there were also indications that, for a small minority of teachers, the move into FE mathematics teaching was not a personal choice. This may have been due to circumstances such as redeployment that were beyond their control.

¹⁷ For example <https://feweek.co.uk/2018/07/12/union-warns-against-another-shoddy-pay-deal-on-eve-of-college-pay-talks/>

Reasons for teaching mathematics in FE colleges (by age group)

A breakdown of reasons for starting to teach mathematics in an FE college by age is shown in *Figure 11*. Examination of the most popular reasons shows some differences between age groups, although these are relatively small.

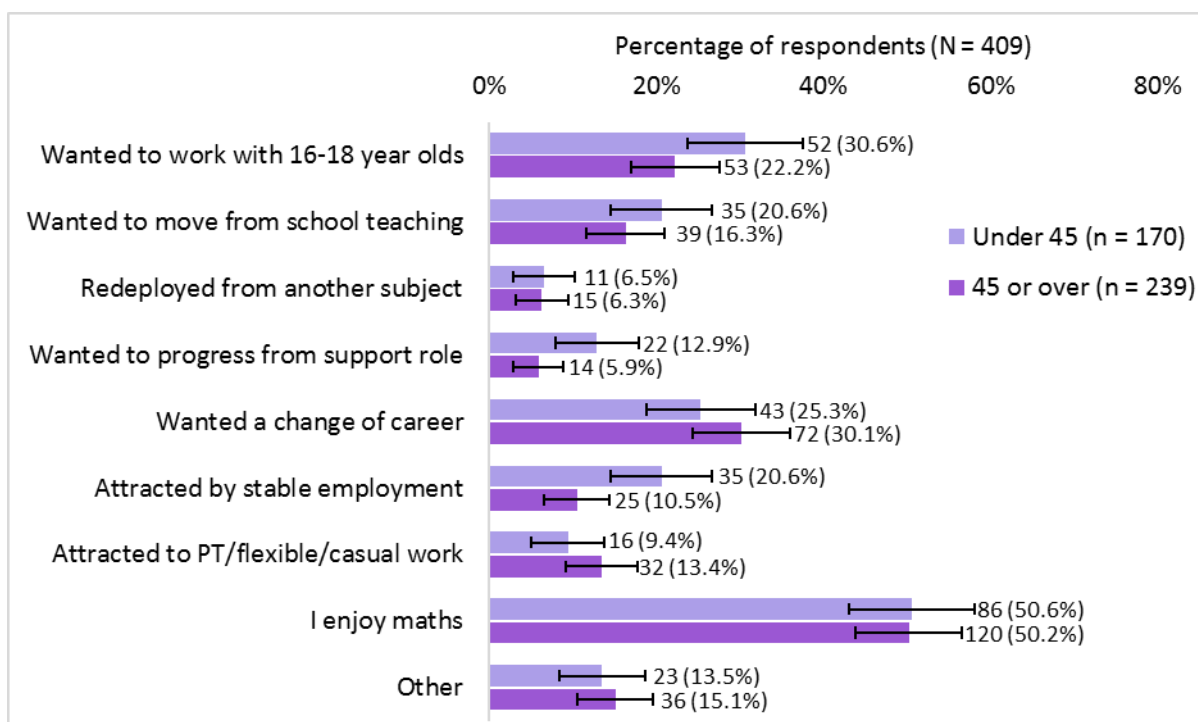


Figure 11: Reasons for starting to teach mathematics in an FE college by age group of respondent (under 45 or 45 and over) for the 409 respondents who provided a response for age. Respondents could select all reasons that applied and the graph shows the percentage and number of respondents who selected each option within each age group. Error bars show the 95% confidence intervals for the percentages within each age group.

A slightly larger proportion of the older age group (30%) stated that they entered FE mathematics teaching because they wanted a change of career, but this was still a common reason amongst the younger age group (25%). This shows that second career choices are made across a wide age range, not just by those aged 45 and over, and that the promotion of FE mathematics teaching as a career change is worth considering for all age groups as an early or later career option.

Wanting to work with 16-18 year olds was a more popular reason for the younger age group (31%) than the older one (22%) though not statistically significant. Similarly, more of the younger teachers (21%) than the older ones (16%) also stated that they wanted a change from teaching mathematics in school. These preferences reinforce earlier indications that there are reasons associated with the learning environment that attract some teachers to working in FE.

In summary, some FE mathematics teachers chose to teach mathematics because it is a subject they enjoy but this is not the only reason that FE mathematics teaching is an attractive option, either as a career change or career progression. Others enter FE mathematics teaching because of a personal preference for the age group or environment,

whilst others have more pragmatic reasons. The reasons may vary but teaching mathematics in FE is often a positive choice. Wider promotion of the reasons why FE mathematics teaching can offer an attractive career option or progression at an early or later career stage would encourage better recruitment and contribute positively to addressing the teacher shortage.

Mathematics qualifications

To better understand the types and levels of mathematics qualifications held in FE, respondents were asked to indicate all mathematics qualifications they had attained from a given list. *Figure 12* shows the frequencies for the highest mathematics qualification held by respondents.

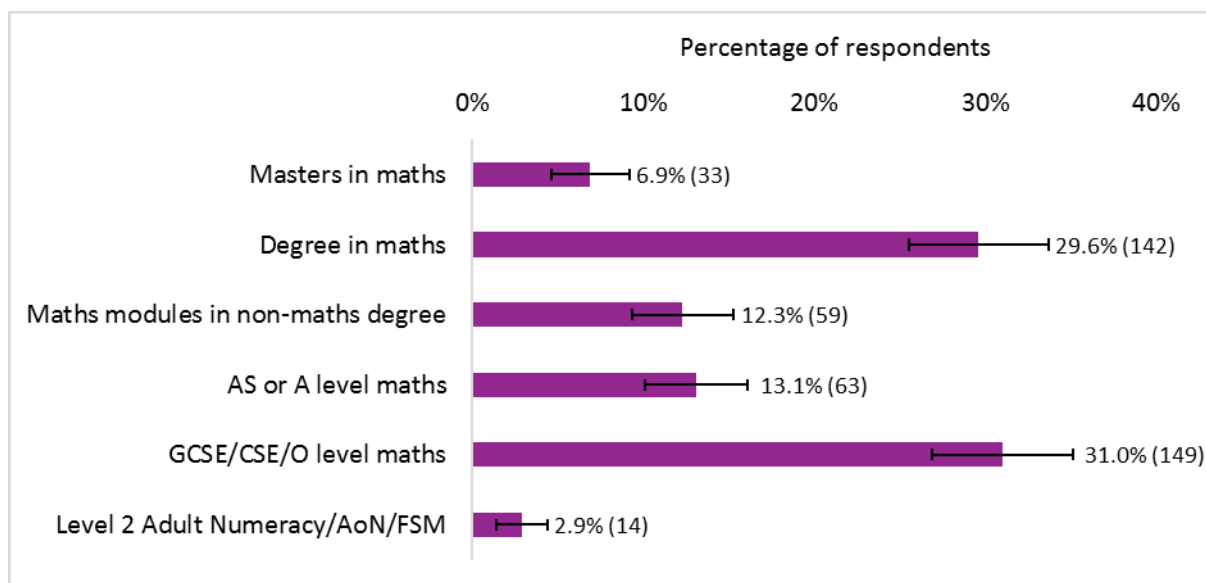


Figure 12: Percentage of respondents reporting each mathematics qualification as their highest. Respondents were asked to select all mathematics qualifications that they had attained and the graph shows the highest qualification selected. Error bars show the 95% confidence intervals for the percentages.

The data show that around one third (36%) of these FE mathematics teachers had a mathematics degree or Master’s degree, which means they would be considered as mathematicians and well-qualified subject specialists. This is the level of mathematics qualification generally expected for mathematics teaching in secondary education. For another third (34%) of respondents, their highest mathematics qualification was only at Level 2 (e.g. GCSE, CSE, O level, Adult Numeracy, Key Skills AoN, Functional Skills Mathematics). The majority of these teachers held a GCSE, CSE or O level qualification but a small minority had only taken Adult Numeracy, Key Skills or Functional Skills. Teachers that are only qualified to Level 2 would typically be viewed as not subject specialists for mathematics but might still teach mathematics as a secondary subject. The remaining respondents (25%) have an A level qualification or have studied mathematics modules in a non-mathematics degree course.

The distribution of highest mathematics qualifications shows a polarisation towards either a degree in mathematics or a Level 2 qualification. This highlights a division between ‘subject specialist’ mathematics teachers and teachers with a much lower level of subject

qualification, although both groups are employed as FE mathematics teachers, sometimes to teach the same qualification (e.g. GCSE). Degree level qualifications are clearly valued for mathematics teaching in FE, but the variation in highest mathematics qualification achieved indicates likely deficits in subject knowledge for some teachers.

The context and range of qualifications taught by FE mathematics teachers sheds light on why this difference may occur. The range of qualification courses taught is highly skewed towards Level 2 and below, with the majority (67%) of respondents teaching on Functional Skills Mathematics courses (which are at Level 2 or below) and/or GCSE Mathematics but very few (7%) teaching A Level. In the context of specialist teacher shortages, teachers may be employed with a minimum level of qualification (e.g. GCSE) as a way of meeting the demand. These teachers may only be employed to teach Level 1 or Entry Level courses. However, from the survey data on qualifications taught, it is clear that a substantial minority (at least 25%) of those who only have Level 2 mathematics qualifications do teach courses other than Functional Skills Mathematics and therefore must be teaching at least some Level 2 qualifications.

This analysis of highest mathematics qualifications needs to be seen in balance with other skills required to teach some of the student cohorts in FE. For example, lower ability groups may demand specialist understanding of students with specific difficulties or disabilities and the roles described by teachers later in this section make it clear that other skills are highly important. Whilst the highest qualification in mathematics is a useful indicator of the level of study undertaken it does not capture knowledge gained subsequently through unaccredited courses or learned in the workplace.

Further examination of the profiles of the respondents whose highest mathematics qualification is at Level 2 (e.g. GCSE, Adult Numeracy) shows that 26% of these teachers have also completed a Specialist Numeracy Teachers' qualification at Level 4 or 5. These qualifications include subject knowledge enhancement and this shows that subject knowledge gaps are being recognised and addressed in some cases. However, 74% of these respondents had neither of these qualifications. Some of these teachers may have updated their subject knowledge without taking an actual qualification (e.g. by undertaking one of the subject knowledge enhancement courses offered in the FE sector). The data show that teacher subject knowledge is still an important area to address in the training and development of the FE teaching workforce but this does need to be considered in conjunction with the wider set of skills required to teach mathematics in the FE environment.

Mathematics qualifications and teaching roles

Patterns in the highest mathematics qualification achieved by teachers vary substantially for the different teacher groups defined by the categories of employment used earlier. *Figure 13* shows the variations in highest mathematics qualification held between teachers of mathematics only, teachers who teach mainly mathematics and vocational (or other subject) teachers who teach some mathematics.

Those who teach mathematics only are most likely to have a mathematics degree (44%) and vocational (or other subject) teachers are the least likely (9%). Some differences in highest mathematics qualification might be expected since mathematics would normally be a secondary subject for vocational (or other subject) teachers and not their main specialism. However, the difference between these teacher groups is large and the number

of vocational (or other subject) teachers with subject knowledge at Level 2 only is high. This highlights a substantial professional development need for subject knowledge enhancement, particularly for vocational (or other subject) staff who move into teaching mathematics.

For those teaching mainly mathematics or mathematics only, the distribution of highest subject qualifications between degree level (32%) and Level 2 (43%) highlights the range of subject knowledge, and potential gaps, even within those who are teaching mathematics as their main subject. This analysis suggests that the workforce contains two distinct groups of FE mathematics teachers: those who are essentially mathematicians who move into teaching the subject in FE, and those who first decide to teach but are then attracted or directed to mathematics despite a lower level of subject knowledge. The latter group may however have other skills that are equally important to FE mathematics teaching. A recognition of these two distinct groups and their specific strengths is important since their knowledge and skills are valuable assets that can be useful in collaborative professional learning.

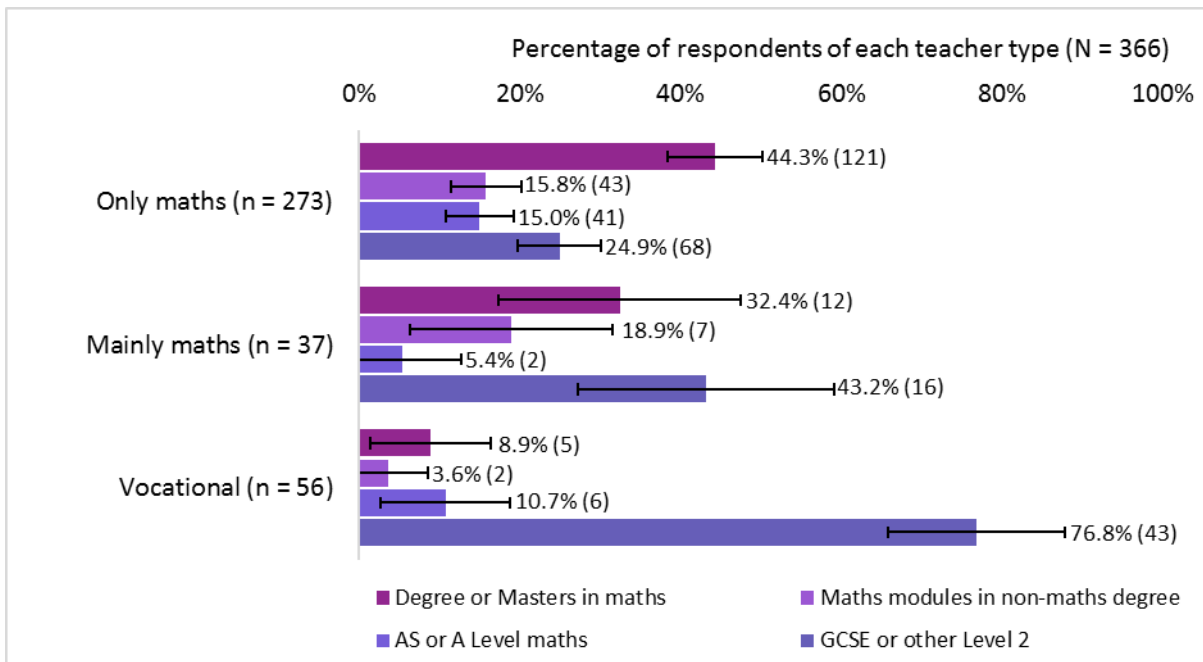


Figure 13: Highest maths qualification for those teaching only maths, those teaching mainly maths, and for vocational (or other subject) teachers who also teach maths. Percentages are by teacher employment category. Degree and masters level maths have been combined, and GCSE and other Level 2 maths have been combined. Error bars show the 95% confidence intervals for the percentages within each teaching category.

The range of teachers' qualifications, backgrounds and experience evidenced in the survey analysis is a characteristic of the FE mathematics teacher workforce that presents complex and varied demands for training and professional development. The range and variation within the workforce does however have great potential if the collective knowledge and skills of teachers from contrasting backgrounds can be effectively utilised in collaborative professional learning.

Teaching qualifications

Teachers were asked to indicate which teaching qualifications they held from a given list. This list included the most common general teaching qualifications and subject specific teaching qualifications in the FE sector, based on a review of previous reports and feedback from the survey pilot. *Figure 14* shows the numbers of respondents who report holding each of the teaching qualifications listed.

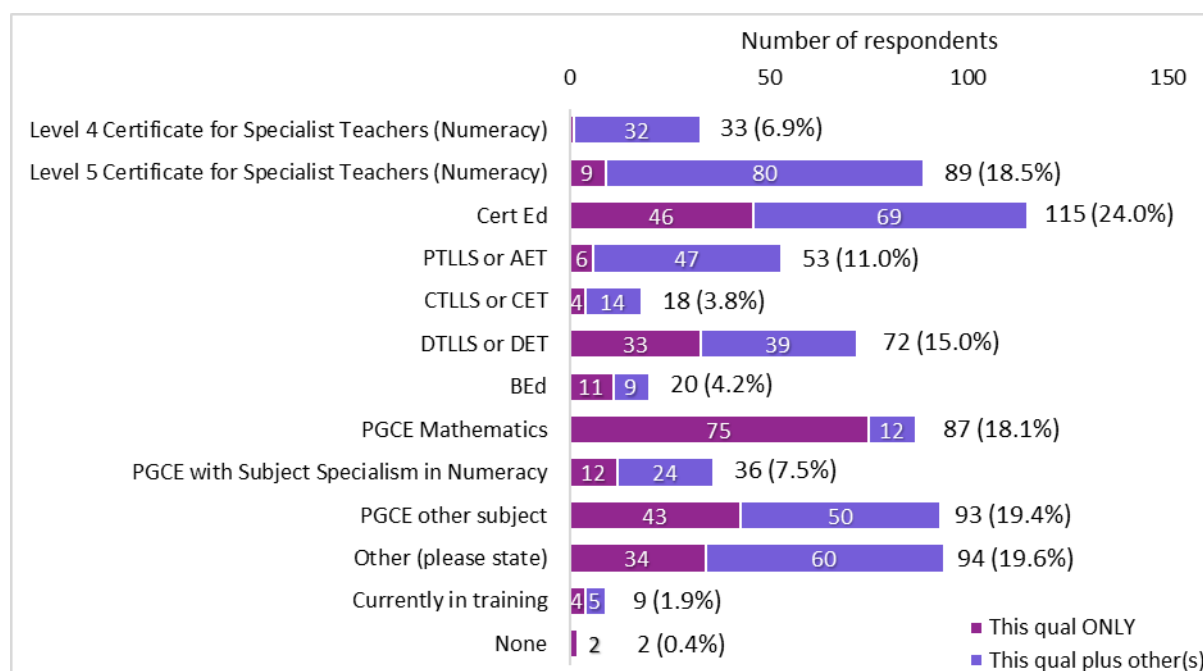


Figure 14: Frequencies for teaching qualifications reported by respondents. Respondents were asked to select every teaching qualification that they had attained, so for each qualification, the graph indicates how many respondents selected that qualification only, and how many selected that qualification in addition to at least one other. The numbers to the right of each bar show the total number and percentage of respondents who hold that qualification.

All except two of the respondents held a teaching qualification or were undergoing training but there was much variation in the number, level and type of teaching qualifications held by individuals. The distribution across the range of listed qualifications illustrates the varied options and accepted routes to qualification in current and prior use. These have been affected by a history of frequent changes to teaching qualifications, accompanied by attempts at regulation and de-regulation in the FE sector. Routes to qualification have also varied over time according to prior qualifications and intended role. For example, FE teachers without degree level qualifications might once have been expected to progress through sector-related qualifications such as PTLLS, CTLLS and DTLLS, whilst teachers with mathematics degrees would have been directed towards PGCE. Considering the different levels of subject qualification in mathematics discussed in the previous section, the spread across these listed teaching qualifications is not surprising.

The range of teaching qualifications extends further if the large number of 'other' qualifications stated by respondents are considered. Amongst these 'other' qualifications there are few exact duplications stated, although several teachers included language and literacy teaching qualifications (e.g. CELTA, TESOL) or added QTS/QTLS.

Further analysis shows that almost half the respondents (45%) had a subject-specific teaching qualification for mathematics or numeracy. This provides some indication of how closely teacher training has been aligned to subject teaching. For example, PGCE Mathematics involves some subject-specific pedagogy and qualifications for specialist teachers of numeracy include both subject-specific pedagogy and subject knowledge enhancement (if necessary). The distinction between subject-specific qualifications for mathematics and numeracy is connected to previous historical divisions in the curriculum, between adult numeracy at (Level 2 and below) and general mathematics teaching (including GCSE and A level). The number of teachers with either numeracy or mathematics specialist teaching qualifications indicates that both are still valued within FE and make a useful contribution to mathematics teacher training but are not seen as mandatory. Since over half the workforce do not hold a subject-specific teaching qualification, there is clearly a need for additional training or CPD to ensure all teachers have the appropriate knowledge and subject-specific pedagogy.

There were no significant differences between the numbers of mathematics and vocational (or other subject) teachers with general teaching qualifications except that vocational (or other subject) teachers were more likely than teachers of mathematics to hold a PGCE in another subject. This is not surprising since mathematics is not their first teaching subject but indicates that subject knowledge and subject-specific teaching approaches are likely to need further development through additional training or CPD.

The overall numbers of teachers with mathematics or numeracy specialist teaching qualifications or only general teaching qualifications gives a clearer picture of the differences between these groups of teachers.

Of the 300 respondents who were teaching mathematics only, 54% had a mathematics or numeracy specialist teaching qualification and 38% held general teaching qualifications only. Within the 50 respondents who were teaching mainly mathematics, 40% held a mathematics or numeracy specialist teaching qualification and 42% had a general teaching qualification only. The slightly lower number of those holding mathematics or numeracy specialist teaching qualifications who teach mainly mathematics may be due to the dual priorities of teaching a second subject, particularly if that subject had initially been their main teaching focus.

For the 77 vocational (or other subject) teachers, the percentage with a specialist mathematics or numeracy qualification is reduced to just 9% whilst 75% had general teaching qualifications only. This suggests a much lower priority for development of their mathematics teaching and again highlights substantial professional development needs.

Figure 15 shows a breakdown of responses for the teacher groups used in the previous section (i.e. teaching mathematics only, teaching mainly mathematics, vocational or other subject teachers also teaching mathematics).

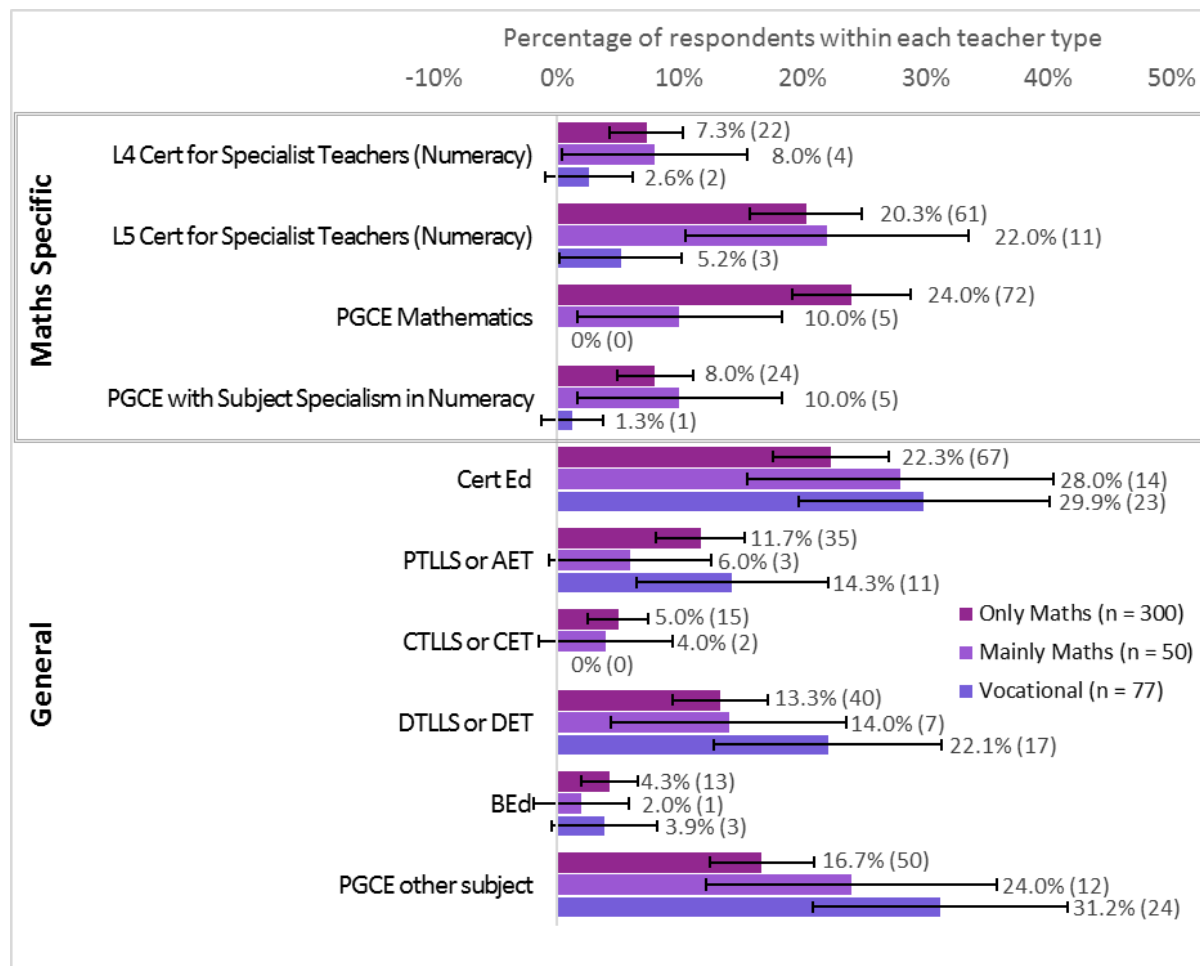


Figure 15: Teaching qualifications held by those teaching only mathematics, those teaching mainly mathematics, and for vocational or other subject teachers who also teach mathematics. Percentages are by employment category. Respondents were asked to tick all that apply, so percentages do not sum to 100%. Error bars show the 95% confidence intervals for the percentages within each teaching category.

This analysis underlines the importance of ensuring adequate and appropriate training and development for those who only teach mathematics as a second subject. Although levels of staff qualification indicate needs for further training and professional development across the FE mathematics teaching workforce, the needs of vocational (or other subject) teachers cannot be overlooked. This group of teachers makes an important contribution to FE mathematics teaching and access to appropriate professional development is essential if the workforce is to be fully equipped with suitably qualified specialist teachers.

Teaching history

Respondents were asked how long they had been teaching in FE, how long they had been teaching in their current FE college and how long they had been teaching mathematics

qualifications in general. *Figure 16* shows the distributions of responses for each of these three teaching situations across the different time periods.

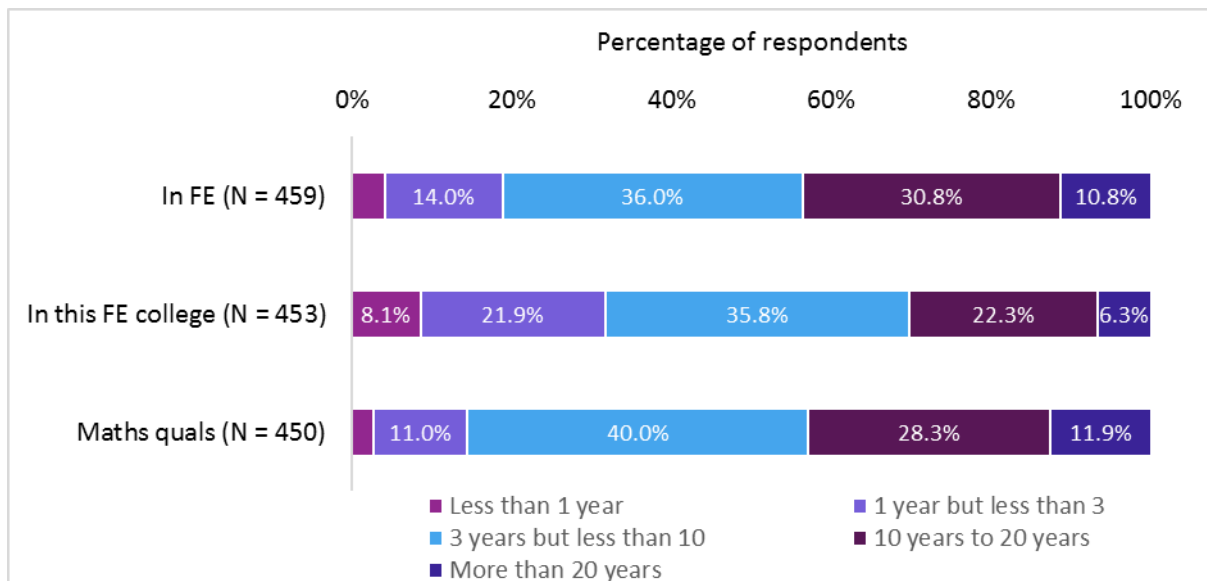


Figure 16: Length of time teaching in FE, in the current FE college, and mathematics qualifications in general. The graph shows the distribution of respondents across the time periods for each teaching situation.

Given that teacher turnover is perceived to be high in the sector, these results shows signs of some short-term stability. 42% of respondents reported having taught in FE for at least 10 years, and 29% had taught in their current college for at least 10 years. 36% reported having taught in FE for 3 to 10 years, with the same percentage teaching in their current FE college for 3 to 10 years. Although this summary does not capture the number who have taught mathematics during all of their time teaching in FE, or just some it, these data indicate some reliance on those already in the FE sector to supply the current demand for mathematics teachers.

Differences between the time spent teaching in FE and teaching in this FE college give some indication of the degree of movement between FE providers (some of which may not be colleges). Over 30% have been in their current college for less than 3 years and just 8% for less than a year. This represents manageable staff turnover for the average FE college but an ongoing need to recruit new staff at a time of national shortage.

The survey respondents also have reasonably long experience of teaching mathematics qualifications, with 40% reporting having taught mathematics qualifications for at least 10 years, and another 40% with 3 to 10 years of teaching mathematics qualifications. The number teaching for less than 3 years is relatively small (11%) and shows how new entrants to FE mathematics teaching only form a small minority of the workforce. Although any evidence of recent recruitment into FE mathematics teaching is encouraging since this helps sustain the workforce, the percentage of new entrants compared to experienced mathematics teachers suggests that efforts to recruit sufficient mathematics teachers are often focussed on drawing from the existing pool. These data should be seen in relation to the satisfaction levels of teachers and the length of time expected to stay teaching

mathematics in FE (Section 6). However, given the age profile of the workforce, this does not indicate a sustainable long term position.

Overall, these data indicate that FE mathematics teachers are quite experienced, either in terms of their time teaching in FE or their teaching of mathematics. Considering the qualifications profiles and varied levels of subject knowledge discussed earlier, these levels of experience suggests that the FE mathematics teaching workforce may have a greater wealth of skills learned through practice than qualifications alone portray. Sustaining this level of experience is dependent on recruiting new entrants to the profession who will be retained for similar lengths of service.

Further analysis of these data show that over half the respondents (56%) have been teaching mathematics for about the same time as they have been teaching in FE. Just under a fifth (18%) have been teaching in FE longer than they have been teaching mathematics. This shows the extent of transfer from another teaching role in FE to teaching mathematics and the important contribution these teachers make to the current workforce. A similar proportion (19%) have been teaching mathematics for longer than they have been teaching in FE. These are important supply routes for sustaining an adequate workforce but, as discussed earlier, the professional development needs of these different teacher groups need to be considered carefully in training pathways and the provision of professional development.

Perceived importance of particular skills and knowledge

Teachers were asked to rate the importance of various types of knowledge and skills to their current role as a teacher of mathematics. *Figure 17* shows the distribution of

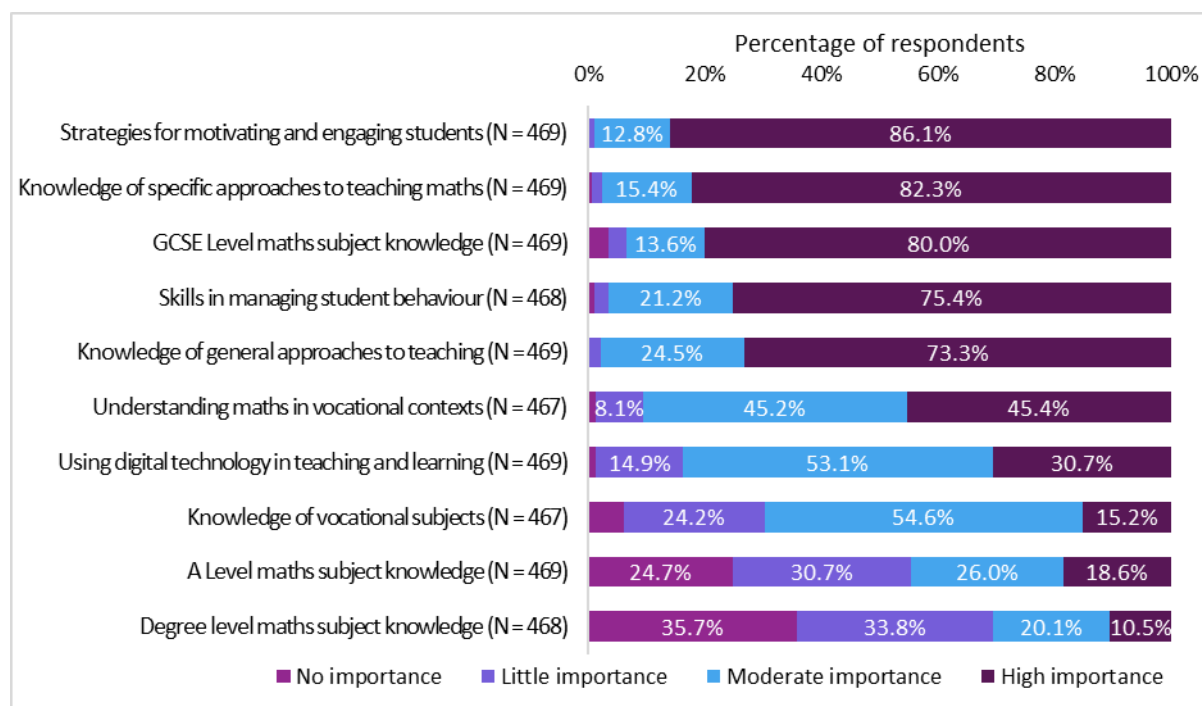


Figure 17: Perceived importance of particular skills and knowledge. The graph shows how importance ratings are distributed across each item.

importance ratings for each of the ten types of skills and knowledge listed, in descending order.

There is a ceiling effect in these responses, with the majority of the items being rated as having moderate to high importance by most of the respondents. This is not unexpected since these items were selected for the survey as being of particular interest and relevance, based on findings from previous studies¹⁸, other reports¹⁹ and consultation with FE teachers during the pilot phase.

The high importance of managing students (motivating and engaging students; managing student behaviour) relative to other activities reflects the importance of these skills for mathematics teachers in FE. Student engagement, motivation and behaviour emerge from these data as major issues for mathematics teachers in FE, many of whom are dealing with classes where attendance is compulsory as a result of the *condition of funding* (e.g. GCSE, Functional Skills Mathematics) rather than being a student-led choice (e.g. A level). This supports other findings²⁰ that highlight student engagement as a major challenge. The high rating of skills to deal with these issues in the survey (86% rating strategies for engaging and motivating students as highly important) suggests a need for professional development amongst existing teachers, and for strategies to motivate and engage students to be a priority in training for those entering the profession.

Some value is placed on understanding mathematics in vocational contexts (45% rating this highly important) but the lower value given to this category by respondents compared to skills in managing student behaviour (75% rating this as highly important) and engaging and motivating students (86% rating this as highly important) is notable. Knowledge of vocational subjects is also considered to be a relatively low priority by respondents. This suggests that teaching approaches with evidence of positive effects on learning such as contextualisation¹⁹ are less important to teachers than the challenges of managing student behaviour, even though these approaches may also aid motivation and engagement.

The relatively low importance placed on skills in using digital technology (31% rating this of high importance but 15% of little or no importance) raises questions for further exploration. Digital technology is sometimes viewed as a way of engaging students and is promoted as a useful approach to FE mathematics teaching²¹. These survey responses indicate that digital technology is not currently a high priority for FE mathematics teachers and the reasons why it does not feature more prominently warrant further exploration if digital resources are to be used more frequently in FE mathematics classrooms.

¹⁸ Dalby, D. M. (2015). A study of the experiences of vocational students learning functional mathematics in further education colleges. (Doctoral thesis, University of Nottingham).

¹⁹ Higton, J., Archer, R., Dalby, D., Robinson, S., Birkin, G., Stutz, A. & Duckworth, V. (2017). Effective practice in the delivery and teaching of English and Mathematics to 16-18 year olds. London: Department for Education.

²⁰ Smith, A. (2017). Report of Professor Sir Adrian Smith's review of post-16 mathematics. London: DFE Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630488/AS_review_report.pdf

²¹ Maughan, S., Smith, J., Mitchell, T., Horrocks, N. & Taylor, A. (2016). Improving Level 2 English and maths outcomes for 16 to 18 year olds: Literature review. Available at: https://educationendowmentfoundation.org.uk/public/files/Publications/16-18_Literature_Review.pdf

Knowledge of approaches to teaching mathematics features strongly (82% rating this of high importance) and general teaching approaches are also perceived to be valuable (73% rating this of high importance). Since classroom teaching is the main focus of these teachers' professional practice, this is not surprising. It does, however, highlight the importance of continuing to address these areas in professional development rather than assuming that qualified teachers have adequate strategies and skills to deal with the challenges of teaching mathematics in FE.

The low rating of A level and degree level subject knowledge (55% rating A level maths subject knowledge of little or no importance; almost 70% rating degree level maths subject knowledge of little or no importance) but the comparatively high rating of GCSE subject knowledge (80% rating this of high importance), may be due in part to the profile of the qualifications these staff are teaching. Very few are teaching at Level 3 (A level 7%; Core Maths 4%) but many teach on courses at Level 2 or below (67% on GCSE and/or Functional Skills). The value of degree level knowledge for these teachers might also be considered alongside their existing qualifications. Teachers who are confident in their current teaching and identify more pressing demands (e.g. student motivation) would seem unlikely to value higher level subject knowledge unless the benefits to current practice were clear. This connection between knowledge value and existing qualifications is examined further in the following subsection.

Value of mathematical knowledge and teacher qualifications

Figure 18 shows the ratings of GCSE level mathematical knowledge by teacher groups with different mathematics qualifications. Most of these teachers view GCSE subject knowledge as highly important, but not all. Noticeably, over 10% of those whose highest qualification is GCSE consider this subject knowledge to have little or no importance. This is surprising but perhaps not atypical of those who teach mathematics at Level 1 or below.

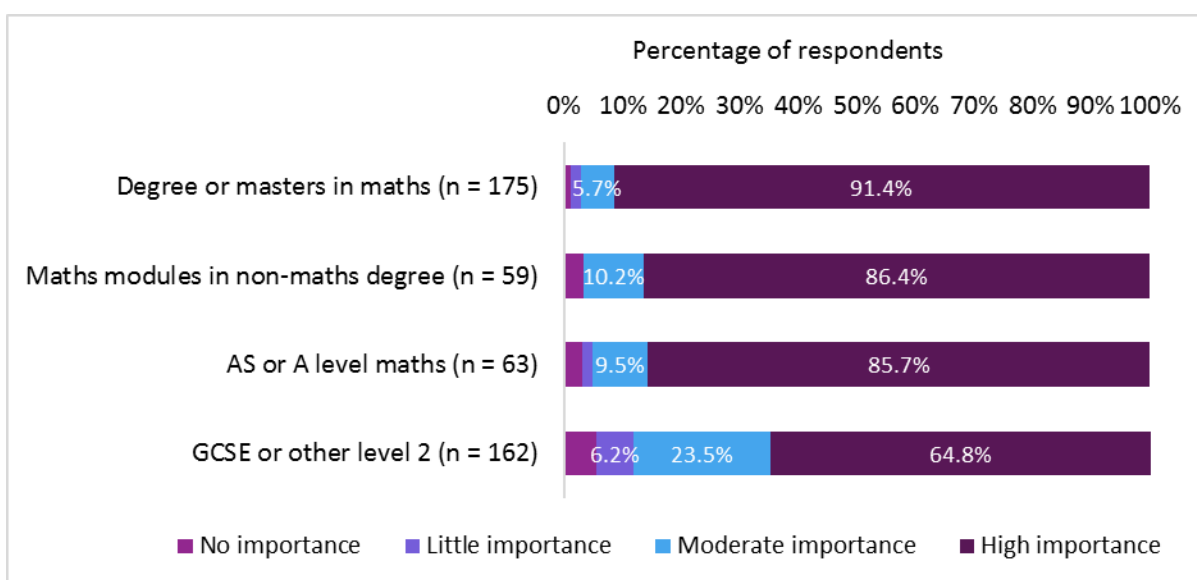
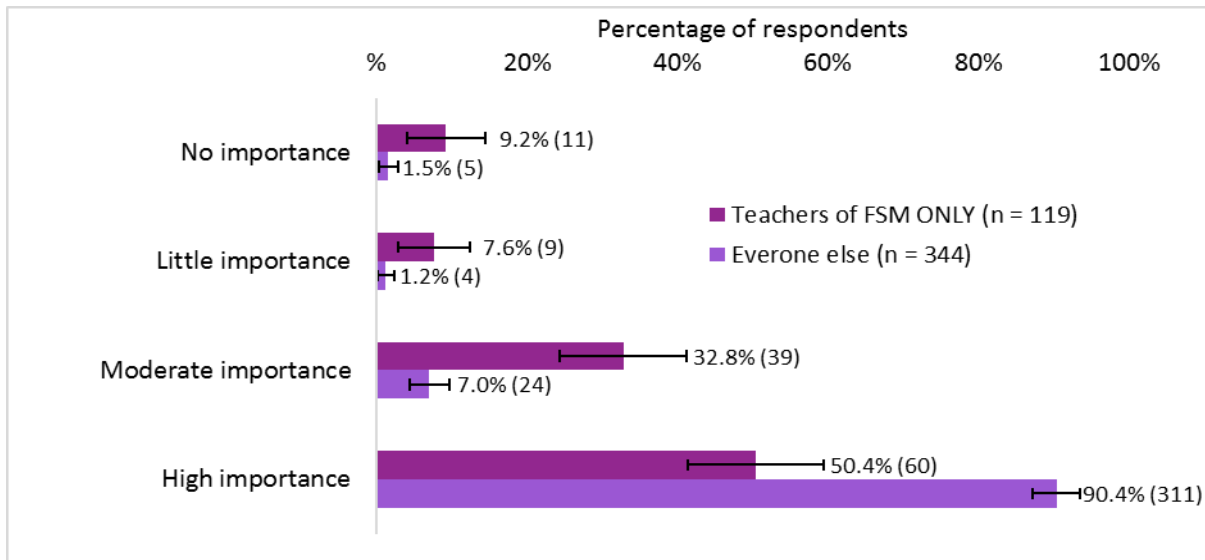


Figure 18: Ratings of importance for **GCSE level mathematical knowledge** for respondents who hold Masters or degree level mathematics, non-mathematics degrees with mathematics modules, AS or A level mathematics, and GCSE mathematics or lower.

To examine this further, the views of those teaching only Functional Skills Mathematics were compared to all other teachers of mathematics. The results, given in *Figure 19*, show a higher percentage of those teaching only Functional Skills Mathematics consider GCSE mathematics to be of little, moderate or no importance.



*Figure 19: Ratings of importance for **GCSE level maths knowledge** by respondents who teach Functional Maths ONLY, compared to all other respondents. Error bars show the 95% confidence intervals for the percentages within each teaching category.*

This lack of connection between GCSE and other mathematics at Level 2 or below indicates a separation of lower level content from GCSE in the perceptions of some teachers. Rather than the mathematics curriculum being connected, with lower level content providing the foundations for higher level study, this indicates a more segmented view. Although there are differences in the content, level and focus of these qualifications, making this separation does not encourage the cross-curricula links that may prove useful to students.

These data highlight a distinction between being a GCSE Mathematics teacher and a Functional Skills Mathematics teacher. Differing professional identities for teachers with different roles may help identify any specific skills required but recognising the commonalities between mathematics teachers is valuable to stimulate useful collaboration or collective professional learning.

Figure 20 shows the ratings of degree level mathematics knowledge by teacher groups with different mathematics qualifications. Only a fifth of those with mathematics degrees (21%) consider the subject knowledge of high importance for their current teaching and 83% of those with AS/A level or GCSE as their highest subject qualification consider it to have little or no importance.

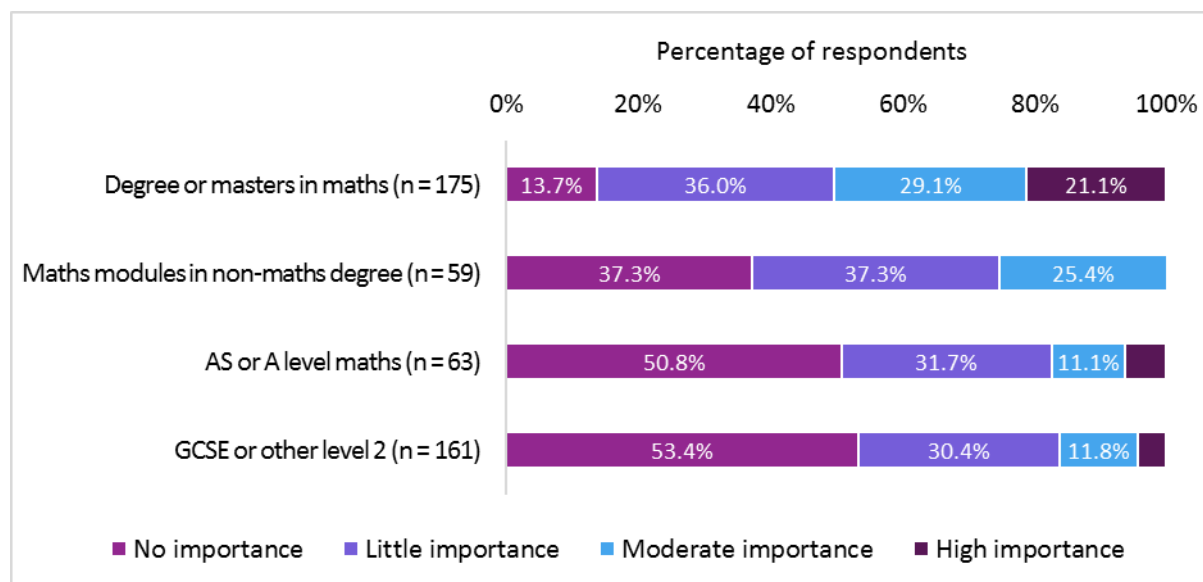


Figure 20: Ratings of importance for **degree level mathematics knowledge** for respondents who hold Masters or degree level mathematics, non-mathematics degrees with mathematics modules, AS or A level mathematics, and GCSE mathematics or lower.

The extent to which teachers see direct benefits from achieving mathematics qualifications several levels above the one at which they are teaching is small. Comparisons of content alone would support these views that higher level knowledge is not directly relevant to lower level teaching. Higher level qualifications in mathematics may however lead to a greater depth of conceptual understanding and personal confidence. This is important when developing alternative pedagogical approaches for students who are finding mathematics difficult or adapting to new curricula with unfamiliar content. The data indicate that teachers do not make these connections and focus on comparisons of content rather than the wider skills that may be enhanced through high level study of mathematics.

Section 4: Continuing Professional Development (CPD)

Types of CPD session

Teachers were asked about the types of CPD they had undertaken in the form of face-to-face sessions or on-line courses. *Figure 21* shows teacher participation in different categories of CPD session and whether these were face-to-face or on-line activities.



Figure 21: Types of CPD in the current academic year. For each type of CPD, the graph shows the number of teachers undertaking face-to-face CPD sessions only, online courses only, and both. The numbers to the right of each bar show the total number and percentage of respondents who received that type of CPD.

College systems, policies and processes featured most prominently in CPD activity. Although this knowledge is important to the smooth operation of the college, its dominance over teaching and learning for those whose professional focus is their classroom practice should be challenged. The level and diversity of professional development needs highlighted earlier provides further evidence that teaching and learning should be a higher CPD priority for FE mathematics teachers.

Compared to other categories, CPD about college systems, policies and processes involved slightly less face-to-face sessions but a substantial amount of on-line activity. CPD for teaching and learning was far less likely to be on-line and curriculum updates were also more often face-to-face than on-line. This suggests that CPD involving familiarisation with information rather than application is often provided online whilst a face-to-face session is more likely for other types of CPD.

The most frequent face-to-face CPD activity was about general approaches to teaching and learning, although mathematics-specific approaches also featured strongly. The emphasis on face-to-face sessions for this category may be linked to the nature of the professional development process for teaching and learning, in which discussion and application of new approaches is essential to developing classroom practice, rather than just acquiring knowledge.

Overall, the balance of activity shows that teaching and learning (general and subject-specific) is a central part of the CPD provided as formal sessions for teachers but much of this is general rather than mathematics-specific. The actual numbers show however that not all teachers have participated in these categories of CPD activity during the last year. This indicates a serious gap in the on-going professional development of the workforce and is further explored for mathematics-specific CPD in the following sections.

Hours of mathematics-specific CPD

Respondents indicated the number of hours of mathematics-specific CPD that they would have received by the end of the 2017/18 academic year. Since the survey was carried out towards the end of the summer term, most of this CPD would have been already completed or planned. These responses therefore capture a fairly accurate overview of CPD for the entire year. *Figure 22* shows the distribution of respondents across the different options for the time spent on mathematics-specific CPD.

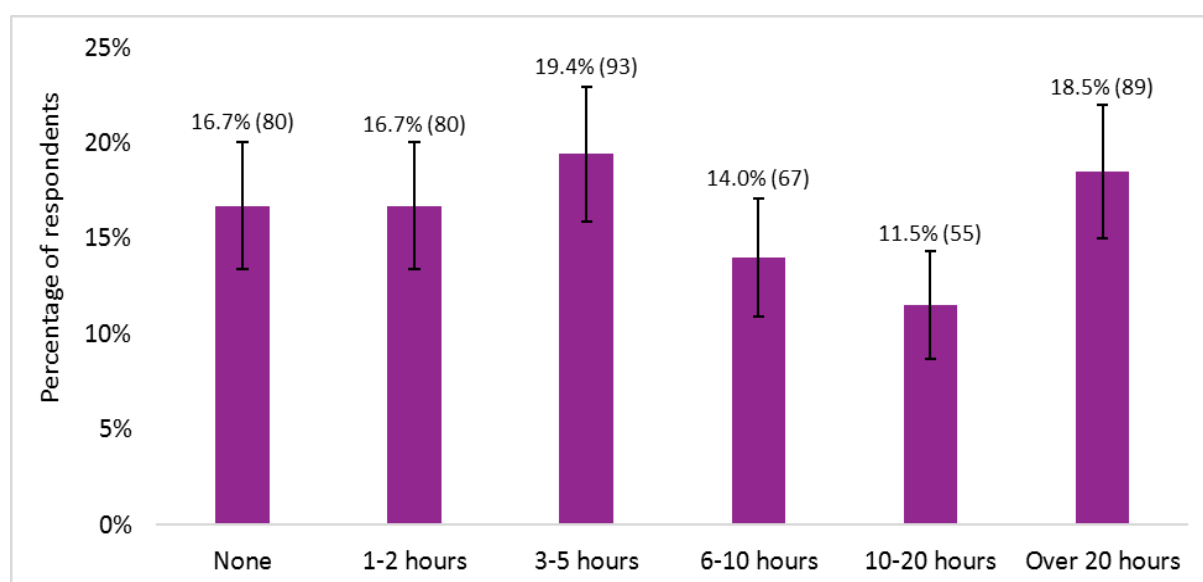


Figure 22: Hours of mathematics-specific CPD in the current academic year. The graph shows the distribution of respondents across the different amounts of CPD. Error bars show the 95% confidence intervals for the percentages

While 89 respondents (nearly 20%) reported receiving over 20 hours of mathematics-specific CPD sessions, just over half (55%) reported 5 hours or less in the year. This amounts to less than one full day over the course of an academic year, which is a small amount of mathematics-specific CPD for a group of teachers with the diverse professional development needs highlighted earlier. Although there is currently no annual CPD entitlement or requirement for FE teachers (since changes in FE workforce regulations in 2012) members of the professional body, the Institute for Learning (IfL), would previously have been expected to complete 30 hours per year. The annual amount of CPD²² varies

²² The Education and Training Foundation (2018) Further Education Workforce Data for England: Analysis of the 2016-2017 Staff Individualised Record (SIR) data. Available at: <https://www.et-foundation.co.uk/wp-content/uploads/2018/03/Staff-Individualised-Records-Data-Report-SIR-25-2016-17.pdf>

widely across the FE sector so it is not surprising to find differences in subject-specific CPD, some of which may be due to inconsistency across the sector in the proportion of CPD time allocated to subject-specific professional development. With student attainment in mathematics being such a high priority in post-16 education, it is surprising that greater emphasis is not being placed on mathematics-specific CPD to ensure these teachers, with their diverse needs, are fully equipped for the challenges they face in the classroom.

Variations in mathematics-specific CPD between colleges

A comparison of mathematics-specific CPD between colleges was carried out to explore whether college factors might be influencing the amount of CPD received by teachers. *Figure 23* illustrates the variation in the amount of mathematics-specific CPD by summarising the data for a selection of providers (i.e. colleges or college groups) from the

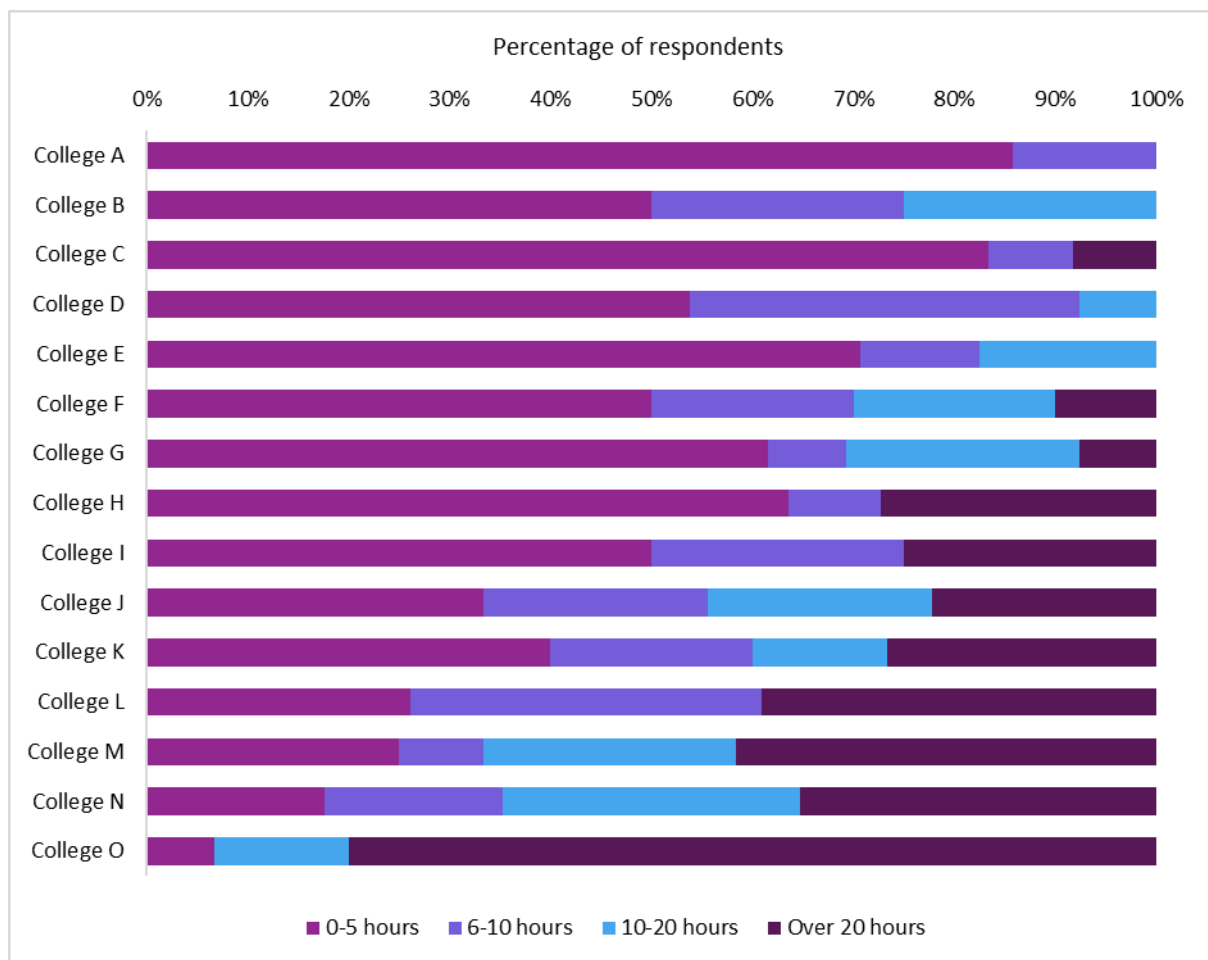


Figure 23: Distribution of respondents according to hours of mathematics-specific CPD for a range of colleges in the sample. The codes on the vertical axis represent individual college providers. College providers are arranged from least to most hours of mathematics-specific CPD.

full range.

The analysis shows substantial variation between providers, indicating that the level of priority given to mathematics-specific CPD is heavily influenced by individual colleges. In the absence of any CPD entitlement or national guidelines, the mathematics-specific professional development of a teacher is largely determined by the CPD strategies of the

place in which they work and there is little equity between the amount of mathematics-specific CPD teachers in different colleges can expect.

Variations in mathematics-specific CPD between teachers

The amount of mathematics-specific CPD for teachers in the different categories used earlier to describe their mode of employment was analysed: *Figure 24* shows the hours of mathematics-specific CPD reported by: teachers of mathematics only; teachers of mainly mathematics; vocational (or other subject) teachers who also teach mathematics; hourly paid or agency teachers; and managers who also teach mathematics.

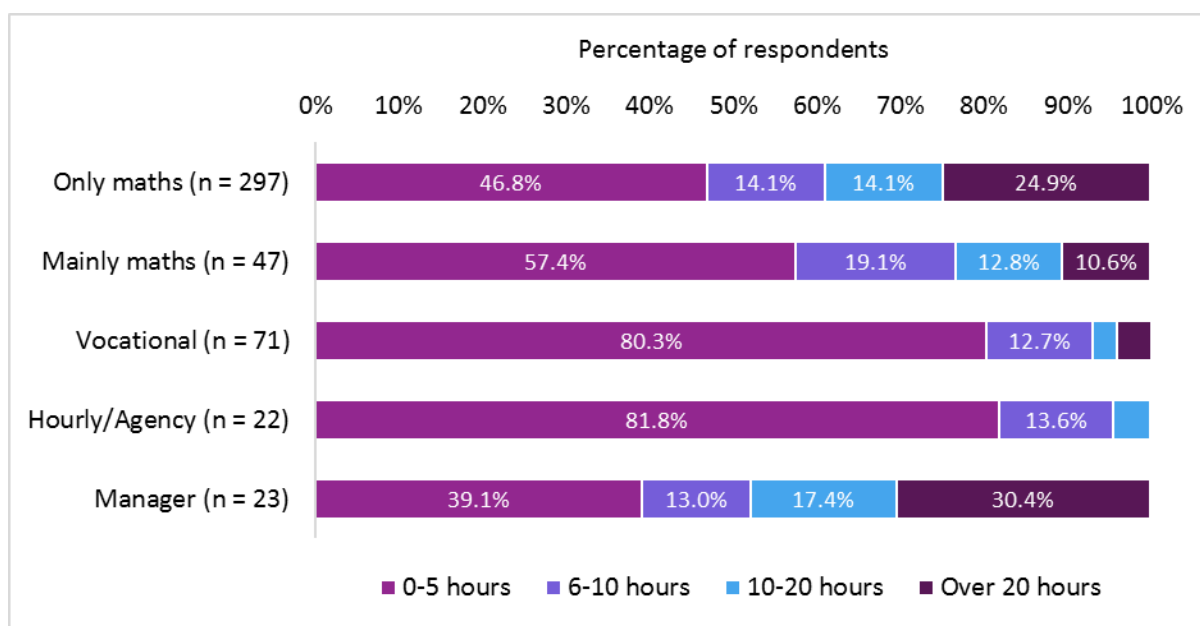


Figure 24: Hours of mathematics-specific CPD received in the current academic year by teachers of only mathematics, teachers of mainly mathematics, vocational (or other subject) teachers who teach mathematics, hourly paid or agency mathematics teachers, and managers who also teach mathematics. The graph shows the distribution of respondents across the different amounts of CPD.

Unsurprisingly, hourly paid and agency staff received the least mathematics-specific CPD, with over 81% of these teachers reporting 5 hours or less. Hourly paid and agency staff constitute a small minority of the FE mathematics teacher workforce but may be the least experienced. It is worth noting that contractual arrangements for agency staff may not include access to CPD provided by an individual FE college and attendance at CPD events by hourly paid staff may incur additional costs for the college. Contractual arrangements may therefore have a limiting effect and adversely affect the quantity of mathematics-specific CPD sessions made available to these teachers.

Vocational (or other subject) teachers report about the same amount of mathematics-specific CPD as hourly paid and agency teachers, with 80% reporting 5 hours or less, and a further 14% reporting 6-10 hours. Thus, nearly 94% of vocational (or other subject) teachers who teach mathematics are receiving less than two days of mathematics-specific CPD over the course of an academic year. Although this is usually their second subject and there are therefore competing CPD priorities, the professional development needs of this group of teachers in areas such as maths-specific pedagogy are likely to be significant,

as discussed earlier in this report (See page 22). Furthermore, many vocational or other subject teachers (68%) only hold Level 2 mathematics qualifications and may also benefit from subject knowledge enhancement.

Usefulness of mathematics-specific CPD

Teachers were asked about the usefulness of the mathematics-specific CPD received during the academic year 2017/18. *Figure 25* summarises the responses.

Most teachers found their mathematics-specific CPD sessions useful, even though the quantity has often been small. However, 22% of respondents rated the CPD sessions they had attended of limited or even no use. This represents a substantial minority and points to the limited quality and/or relevance of the mathematics-specific CPD sessions provided for some teachers.

To explore this issue further, an examination of teachers' responses to CPD by the categories of employment used earlier was carried out. The analysis is summarised in *Figure 26*.

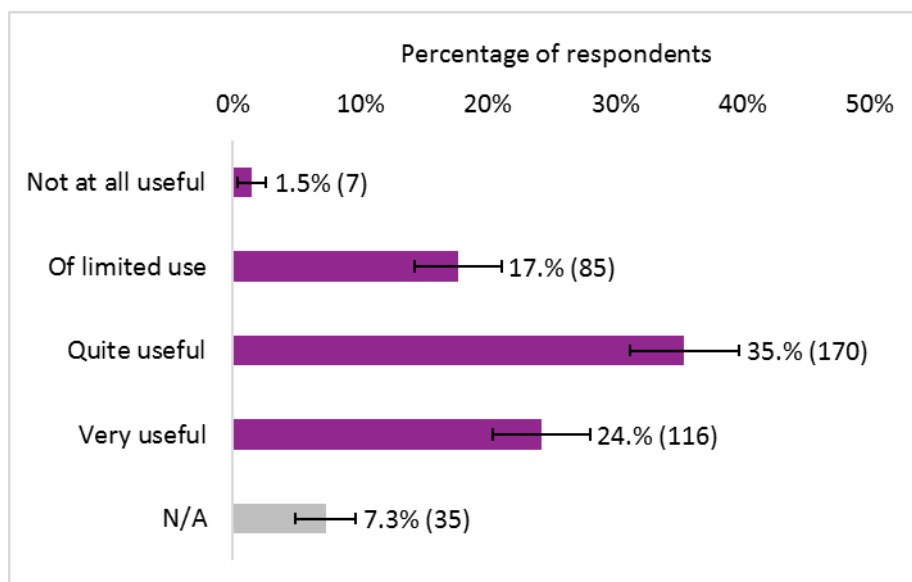


Figure 25: Percentage (and numbers) of respondents giving each of the four usefulness ratings for their mathematics-specific CPD (as well as those who selected N/A because they had no maths-specific CPD). Error bars show the 95% confidence intervals for the percentages.

This shows a mixed picture, with slightly more teachers of 'Mathematics only' (33%) and those teaching 'Mainly mathematics' (31%) finding the CPD very useful compared to vocational or other subject teachers (24%). Greater enthusiasm might be expected from those with a singular focus on mathematics teaching compared to the dual priorities of the other two groups. However, more teachers of 'Mathematics only' (26%) and vocational or other subject teachers (26%) found their CPD of limited or no use compared to those teaching mainly mathematics (17%). The differences between these categories are small

and the overall findings show how mathematics-specific CPD sessions have been useful to many teachers but are not satisfying the needs of all.

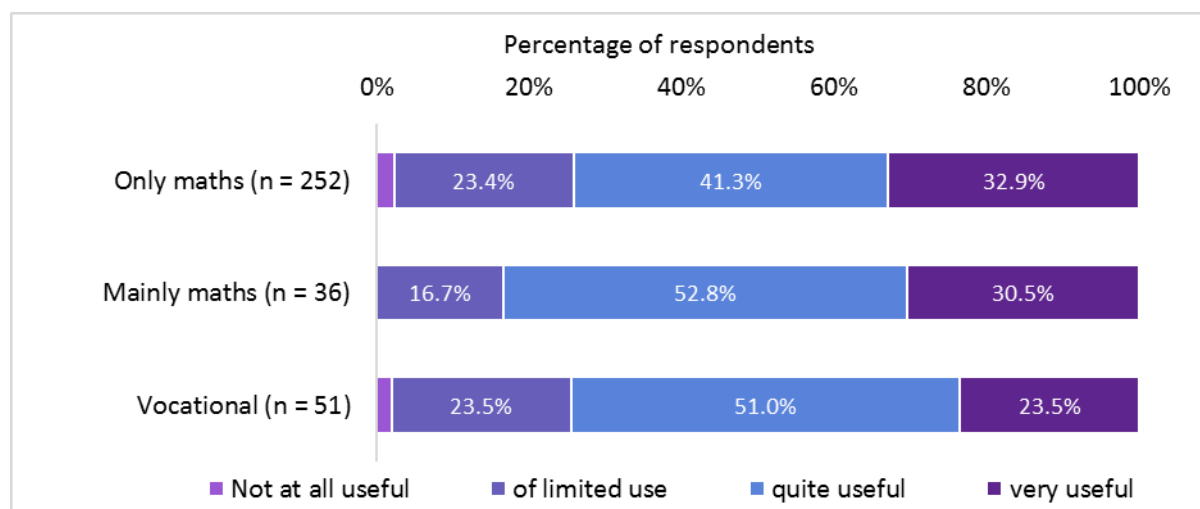


Figure 26: Distribution of usefulness ratings for mathematics-specific CPD for those teaching only mathematics, those teaching mainly mathematics and vocational (or other subject) teachers. There are no differences according to these employment categories.

The earlier analysis in this report indicated that the professional development needs of the teacher workforce were diverse. With more than a quarter of mathematics-only teachers and vocational (or other subject) teachers finding their mathematics-specific CPD sessions of limited or no use, this suggests that CPD sessions may not be sufficiently differentiated to meet the wide range and diversity of professional development needs in the FE mathematics teaching workforce.

Efficient targeting of appropriate CPD to address these needs is dependent on the accurate identification of the CPD needs. In the context of earlier findings about teachers' entry routes, experience and qualifications, the use of regular and accurate individual training needs analysis would be an important first step to achieving effective CPD.

The usefulness of other CPD opportunities

In addition to CPD sessions, teachers were asked what other opportunities for CPD they had experienced during the academic year from a given list and to rate their usefulness. Figure 27 gives a summary of the responses.

The activity found most useful by teachers was informal conversations with colleagues, with over 60% rating this very useful. Such activity would typically involve incidental discussion between teachers in corridors, staff rooms and classrooms that often takes place when working in close proximity. When mathematics teaching occurs across multiple sites or faculties this becomes more difficult, but similar conversations might also be achieved through established a regular forum for informal classroom-based discussion, face-to-face or on-line. The high value placed on these discussions by teachers would suggest that there is a need to establish a way of facilitating and encouraging this informal discussion between mathematics teachers, particularly in colleges where they are dispersed across sites and interactions with mathematics colleagues are less likely to occur naturally. Teachers also valued observing peers more highly than being observed and

receiving feedback (79% rating peer observation as helpful or very helpful; 59% found being observed helpful or very helpful). Lesson observations are a common feature of the typical FE college strategy for improvement, often as a formal part of the quality assurance process. This preference for observing others rather than being observed indicates that the quality and relevance of the feedback received is less helpful than reflection on the observed classroom practices of other teachers. The way in which classroom observation is used and the feedback given or received is therefore important. Using lesson observation as a supportive rather than judgemental activity may provide better developmental opportunities. Although there may be practical challenges in arranging peer observations and some resistance due to the traditions of teacher autonomy and privacy in the classroom, these provide useful CPD opportunities that are highly valued by the teachers who have experienced them.

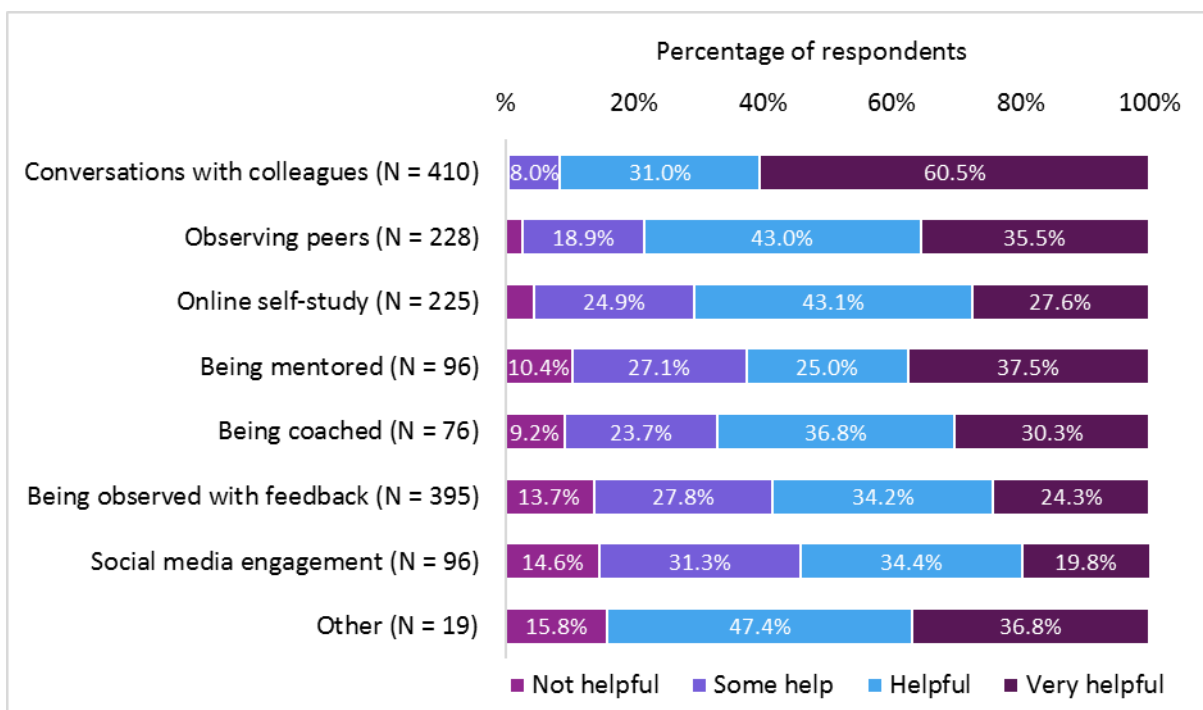


Figure 27: Participation in other forms of CPD and teachers' perceptions of its usefulness. The graph shows the ratings of usefulness for those who had participated in each type of activity.

Participation in mentoring and coaching was low in comparison for the survey respondents but rated highly (63% finding mentoring helpful or very helpful; 67% rating their coaching as helpful or very helpful). Considering the value of these activities indicated by respondents, it would seem appropriate to widen use of these approaches within college CPD plans.

Section 5: Other responsibilities

Use of non-contact hours

Teachers reported approximately how many non-contact hours per week they spent on a range of activities outside the classroom. The list of activities in the survey was based on previous studies and then refined through a process of consultation and piloting with FE providers. *Figure 28* shows the distribution of time spent on each activity, with the list of activities arranged in descending order of time spent. The results are presented in hours rather than percentages and include values for teachers on different numbers of contracted hours.

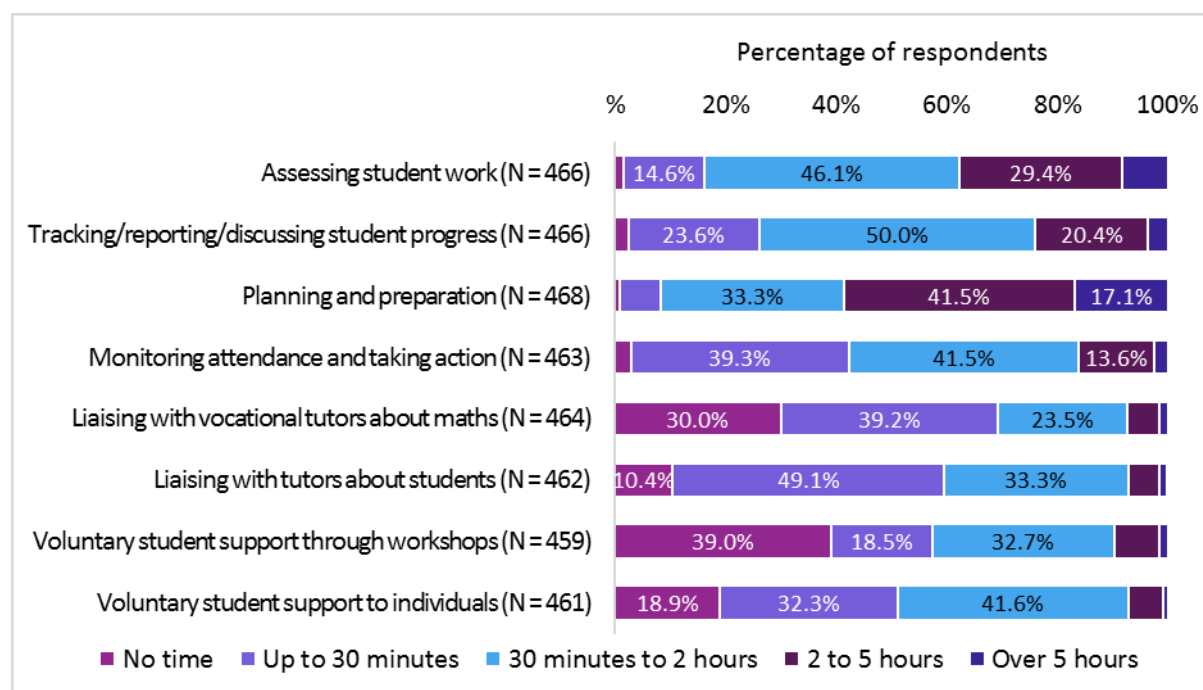


Figure 28: Activities on which non-contact hours are spent. The graph shows how non-contact hours are distributed across each activity.

Activities concerned with assessment of student work, monitoring student progress and lesson planning feature most strongly in this analysis. This emphasis is not surprising, although the large amount of time spent by some teachers on these tasks means they are demanding, even for a full-time teacher. For example, 42% of teachers report spending 2-5 hours a week on planning and preparation whilst 17% spend over 5 hours. There is also wide variation in the time spent, with for example, 29% spending 2-5 hours assessing student work but nearly 15% of teachers spending no more than 30 minutes on the same activity. Some of this variation may be due to differences in contracted hours and the following analysis gives a clearer picture of the spread of time across these activities for teachers on comparable contracts.

Use of non-contact hours by full-time mathematics teachers

In *Figure 29*, responses from full-time teachers only have been used to gain a better sense of the extent of activity outside the classroom compared to the average (mean) contracted

class contact hours of 23 hours a week for these teachers. The general profile and ordering of activities is similar to that for all teachers, with assessment, monitoring student progress and planning featuring strongly. Again, there is wide variation, which means contract size is not the only factor affecting the amount of time spent on these activities.

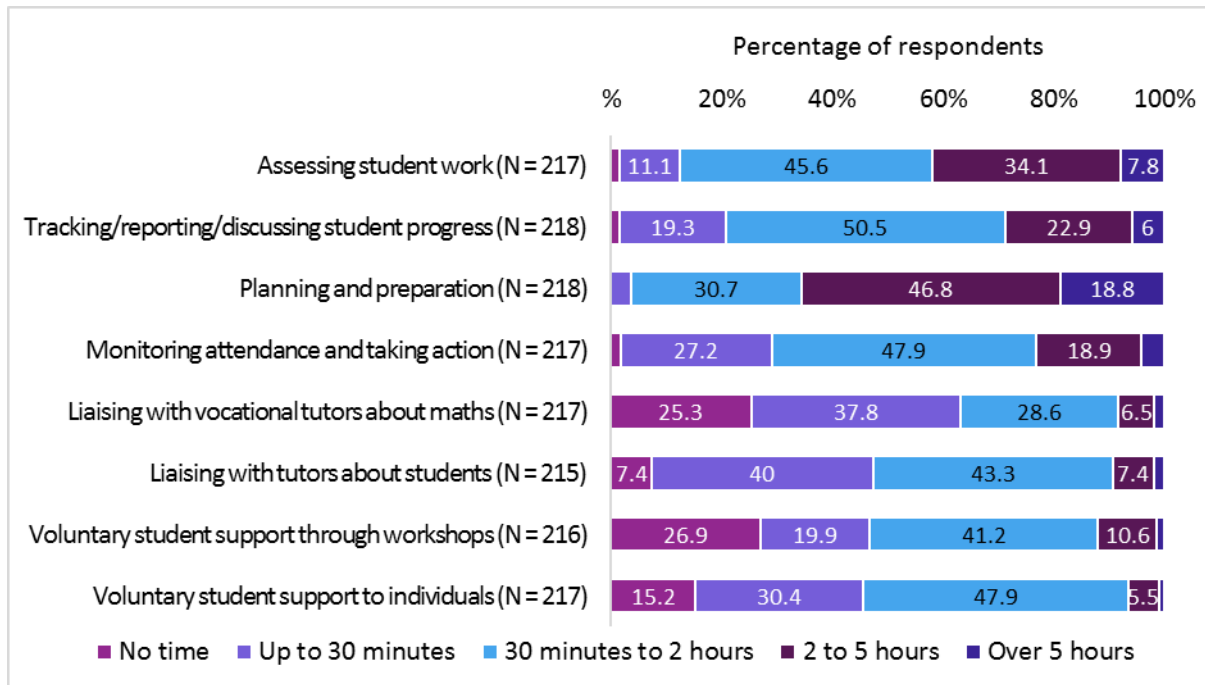


Figure 29: Activities on which non-contact hours are spent for **full-time teachers who only teach mathematics**. The graph shows how non-contact hours are distributed across each activity.

The prominence of assessment in both analyses shows that assessing student work in mathematics is an important element of mathematics teaching in FE colleges. There is evidence that this may create a heavy workload for some teachers (e.g. for full time teachers, 34% spending 2-5 hours; 8% over 5 hours). Traditionally, homework has taken a low profile in FE²³ but these data show that a substantial amount of assessment is taking place, whether from homework or in-class assessments. This is likely to be affected by the number of different student groups taught which, as discussed in Section 3, may be seven or eight groups for a full-time FE mathematics teacher. The quality of feedback is however important to student learning and finding a balance between quantity of assessment and the quality of feedback to students is desirable.

Tracking student progress also has a fairly high profile, suggesting that many teachers are following the progress of their students carefully and reporting on this on a regular basis. 70% of teachers spend up to 2 hours a week on this activity and 23% take 2-5 hours.

All the full-time teachers spend at least some time on planning and preparation each week but the distribution of time used shows wide variation. 31% reported 2 hours or less,

²³ Higton, J., Archer, R., Dalby, D., Robinson, S., Birkin, G., Stutz, A. & Duckworth, V. (2017). Effective practice in the delivery and teaching of English and Mathematics to 16-18 year olds. London: Department for Education.

whilst 47% took 2-5 hours and 19% over 5 hours. Although less experienced teachers might be expected to spend more time on this activity, the numbers of respondents who are new entrants to FE mathematics teaching is small. Variation may also occur as a result of college approaches to collaborative planning which can reduce individual lesson preparation time or, as already discussed, may result from the number of groups and different mathematics qualifications taught.

Monitoring attendance and taking action also takes up a substantial amount of time with 19% of mathematics teachers estimating this takes 2-5 hours a week and only 2% not engaged in any activity under this category. This reflects the high level of importance attached to student attendance at mathematics sessions following from the condition of funding. It also indicates a reliance on mathematics teachers to take action. Monitoring attendance is a time-consuming administrative task which these data show is often being added to mathematics teachers' workloads rather than making more effective use of electronic systems and support staff to improve student attendance for mathematics.

Voluntary workshop support for students features less highly, but is still fairly common practice with 11% of the respondents spending over 2 hours a week on this activity. This indicates a commitment to supporting students by teachers that goes beyond their contracted hours. However, it also highlights some variation since 27% of teachers do not provide voluntary support in this way. This is explained by earlier findings (Section 2) that show some staff teach in mathematics workshops as part of their contracted hours rather than on a voluntary basis. These contractual differences between colleges mean some teachers are carrying a heavier workload than others by staffing workshops on a voluntary basis.

In addition, most teachers (85%) provide voluntary support for individual students outside timetabled classes. For over half (52%) of the respondents this amounted to at least 30 minutes a week and 6% spent over 2 hours. Overall, a considerable effort is being made by most FE mathematics teachers to provide extra support for students through workshops or individual interventions. Much of this is additional to their contracted contact hours.

Liaison with other tutors shows a noticeable difference between communication concerning students and liaison about mathematics. A quarter of the respondents (25%) did not spend any time liaising about mathematics whilst only 7% reported no liaison about students. Although it is pleasing that liaison is taking place, the low level of communication about mathematics shows that this is still a low priority. Despite attempts to embed mathematics in vocational studies, and the benefits of connecting mathematics to vocational learning²⁴ this is still a low priority and the mathematics taught is still largely disconnected. Connections on a more operational level about students seem to demand more attention than linking the mathematics curriculum.

²⁴ Dalby, D. & Noyes, A. (2016). Locating mathematics within post-16 vocational education in England. *Journal of Vocational Education & Training*, 68(1), 70-86.

Section 6: Changes over time

Expected mathematics teaching load for the coming year

Figure 30 shows the expectations of teachers concerning their teaching load in the coming year. Since the survey was carried out late in the academic year (2017/18) when provisional timetables were well developed, the responses provide a reasonably accurate overview of expected workload changes for 2018/19.

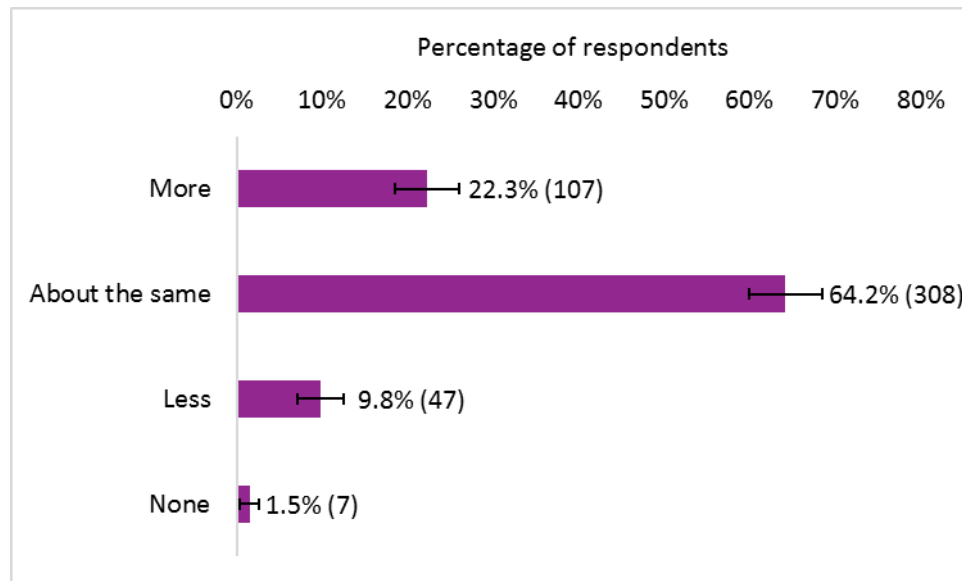


Figure 30: Expected mathematics teaching load in the coming year. Percentage (and number) of respondents who selected each option. Error bars indicate the 95% confidence intervals for the percentages.

The responses show that the majority of teachers are expecting to teach about the same amount of mathematics (64%) or more (22%) in the coming year. The increase may be due to those teaching mathematics in addition to another subject spending a greater proportion of their contact hours on mathematics but it could also be affected by any general increase in contact hours within the participating colleges.

The small proportion of staff (10%) expecting to teach less hours of mathematics may include planned moves to other positions such as management that involve less teaching, or expectations of remission for agreed additional responsibilities. Overall, there is a reliance on existing staff to provide the same, or a greater amount of mathematics teaching.

Expected work situation over the next three years

Since the survey took place towards the end of the academic year, teachers' expectations of their work situation for the following year should also be fairly reliable since many role or employment changes would have already been planned. Figure 31 shows a summary of teachers' responses.

From these responses, there are signs of some short-term stability in the mathematics teaching workforce, with 83% expecting to continue in their current role, or a similar one,

for the following year 2018/19. For those not remaining in the same or similar role, their changes in employment are spread thinly across the options listed. Some are expecting to remain in the same college but in a different role (under 4%), whilst others intend moving to similar or different roles in other FE colleges (under 2%) and some are planning to remain in teaching but not in an FE college (less than 1%). Another small group (4%) were still undecided about their work situation for 2018/19. Although the percentages are small, the collective drift from teaching mathematics in the same FE college is a concern when a national shortage of teachers makes recruitment difficult and time-consuming.

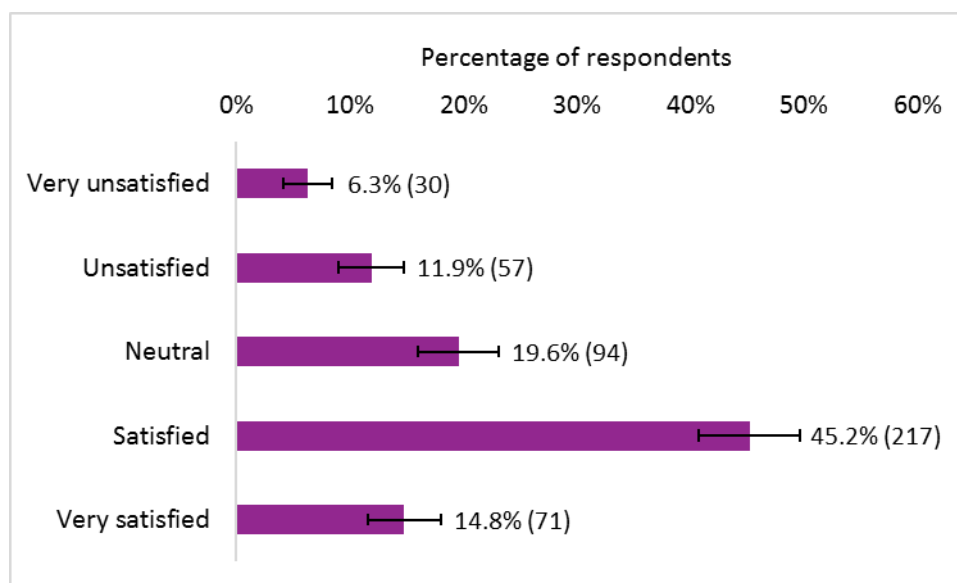


Figure 31: Job satisfaction ratings. The graph shows the percentage (and number) of respondents who selected each satisfaction rating. Error bars show the 95% confidence intervals for the percentages

Over the following two years the picture becomes less stable with the percentage expecting to stay in the same or a similar role reducing to 54% (2019/20) and 42% (2020/21), whilst the numbers stating they are undecided rises to nearly 21%. There are also indications that over time more staff expect to change roles within the same college, move to another college, transfer to teaching roles outside FE (e.g. school), move out of education altogether or retire. The percentages for these individual categories appear relatively small but when combined represent over half the workforce, indicating that longer-term stability at college level is still an issue.

A lack of workforce stability makes long-term planning difficult for colleges and affects the quality of provision. It also increases the workload of managers since large amounts of time are often necessary to seek and appoint suitably qualified new staff in the current climate. Meanwhile, unfilled posts result in further increases to workload, as classes need to be covered by other teachers and managers, or designated to less-qualified teachers on a temporary basis, which affects quality and continuity for students.

By considering those who are expecting to leave the workforce altogether in three years' time, a better picture of the impact on the overall FE mathematics teacher workforce is obtained. The numbers of teachers expecting to either retire, teach outside FE or move into a non-teaching role in the next three years constitutes over 15% of the survey respondents with a further 21% undecided. Data considered earlier in this report shows

that the number of new entrants to the profession over the last three years is relatively small (11%) and falls well below the expected combined drift of teachers out of FE mathematics teaching for retirement or other reasons. There are clear implications that the current FE mathematics teacher shortage is likely to become steadily worse over the next few years unless there is a policy change to reduce demand or a substantial intervention to boost recruitment.

Job satisfaction

Teachers were asked how satisfied they were with their current role as teacher of mathematics. *Figure 32* summarises the job satisfaction ratings given by respondents.

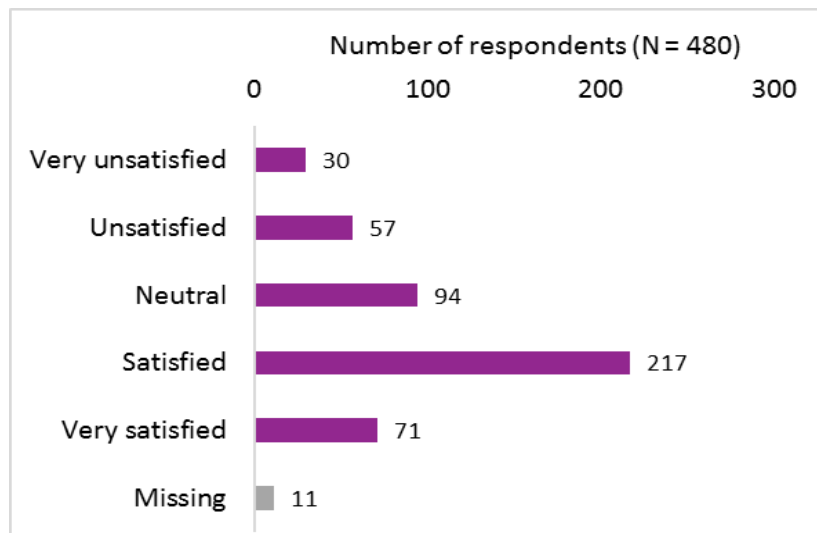


Figure 32: Job satisfaction ratings. The graph shows the number of respondents who selected each satisfaction rating.

The overall levels of job satisfaction reported are good, with 288 teachers (60%) indicating that they were satisfied or very satisfied with their current role. This is encouraging in a sector where lower pay and perceptions of less favourable conditions of service have been raised as issues for many years. However, the 87 teachers (18%) who are unsatisfied or very unsatisfied represent a threat to stability. In view of the number of new entrants to the profession in the last three years (Section 3) and the on-going high demand for mathematics teachers in FE, retention of the current workforce is a key factor. There are clearly still some problems to be overcome in the FE sector if greater mathematics workforce stability is to be achieved and a workforce developed that is adequate to match the expected demand.

Conclusions

The main findings from the survey fall into three broad areas: 1) the composition of the mathematics teacher workforce, 2) their training and professional development needs, and 3) the nature of their roles and responsibilities.

Composition of the workforce

The composition of the mathematics teacher workforce in the FE college sector is distinctive with respect to teachers' prior experience and entry routes. It is important that decision makers understand this distinctiveness as it has a bearing on recruitment, training and professional development.

The *backgrounds and prior occupations* of FE mathematics teachers are diverse. Teaching mathematics in FE frequently follows a career change but teachers come from a range of occupations. The most common prior employment for FE mathematics teachers is working in industry, business or self-employment. Other common entry routes involve a transition from vocational (or other subject) FE teaching or from teaching mathematics in schools. Very few are in full-time study immediately prior to teaching mathematics in FE. The range of prior occupations and entry routes differs substantially from the typical route into school mathematics teaching, i.e. as a first career. In summary, the FE mathematics teacher workforce consists of teachers who have followed three main pathways:

1. those undertaking a significant career change from outside education to teaching mathematics in FE;
2. those with experience of teaching in FE who have changed subject or added mathematics as a second subject;
3. those who have taught mathematics elsewhere before moving into FE.

Contractual arrangements (e.g. full-time or part-time) and actual timetabled teaching for this sample of teachers show that the majority (63%) are specialising in mathematics teaching (i.e. teaching mathematics only) but around a quarter (26%) teach another subject as well as mathematics. Most of those specialising in mathematics teaching are on full-time contracts and the remainder on part-time contracts. Those teaching another subject as well as mathematics may teach mainly mathematics (10%) or be employed as vocational (or other subject) teachers but teach some mathematics as a second subject (16%). A substantial contribution to the workforce (26%) is made by these teachers who have dual priorities. A staff audit carried out by each college shows slightly less full-time mathematics specialists and slightly more hourly paid teachers than in this sample but the overall contractual profile is similar.

Teaching mathematics in FE is an attractive *career change or progression* for both younger and older people from a range of backgrounds. Teachers enter FE mathematics teaching for a variety of reasons, often based on a personal preference or choice. Common reasons to teach mathematics in FE include wanting to work with 16-18 year olds (25%) or to move away from teaching in school (17%), as well as having a personal enjoyment of the subject (49%). This diversity is important when considering ways of attracting more mathematics teachers into FE.

There is evidence of some short-term *workforce stability* since the majority of respondents expect to continue in a similar role for the coming year and job satisfaction levels are

reasonably good (60% satisfied or very satisfied). The medium to long term prospects are less certain. In three years' time 15% of the current workforce expect to have moved out of FE mathematics teaching and over a fifth are undecided about their future plans, whilst new entrants to the profession have only amounted to 18% of the workforce in the last three years. It is likely that the mathematics teacher shortage in FE will increase unless there is a downturn in demand or significant interventions to boost recruitment.

Training and professional development

There are varied and substantial training and professional development needs within the mathematics teacher workforce that result from the diversity in qualifications and prior experience. These need addressing either within pre-service training or in appropriate professional development pathways for individuals.

Nearly all of the respondents have undertaken a *teaching qualification* or are currently in training. Much of the current workforce has experience of teaching mathematics and/or teaching in FE but just under half (45%) do not hold a *specific mathematics (or numeracy) teaching qualification*. This indicates a clear need for subject-specific pedagogy, in particular for those new to FE mathematics teaching or experienced vocational (or other subject) teachers who have made a transition into teaching mathematics.

Teachers have varied levels of *qualifications in mathematics*. Some have undergraduate mathematics degrees (30%) or a Master's degree (7%) whilst others only hold a Level 2 qualification (34%). Some of the FE mathematics teacher workforce are teaching at the same level as their highest qualification in mathematics. Although some teachers have additional non-accredited subject knowledge, there is an outstanding need for subject knowledge enhancement in professional development plans.

Most teachers of mathematics in FE experience very little mathematics-specific Continuing Professional Development (CPD) (e.g. 55% reported 5 hours or less for 2017/18). The number of hours per year varies widely, even for those teaching mathematics as their main subject, and there are striking differences between colleges. Teachers in some colleges are provided with very few mathematics-specific CPD sessions whilst staff in other colleges report that they attend the equivalent of several days per year. Those who teach another subject in conjunction with mathematics are less likely to participate in mathematics-specific CPD, although these teachers may have substantial training needs. Given the priority of increasing post-16 mathematics attainment and the diverse needs of the workforce, the support for mathematics teachers in terms of mathematics-specific CPD is low.

Teachers value opportunities for *informal professional development*, particularly where this involves discussion with colleagues. Coaching or mentoring activities are also considered useful and teachers report that they benefit more from observing their peers than being observed. The diversity of the teacher workforce provides a rich, and often untapped, resource for this type of informal professional development.

Roles and responsibilities

The roles and responsibilities of mathematics teachers in FE reflect *current priorities in the implementation of post-16 mathematics policy*. There is some specialisation in teaching roles according to the qualifications being taught. Teachers also carry out a range of out-

of-class activities including administrative tasks and those directly connected to classroom teaching and support for students.

The majority of mathematics teachers in general FE are teaching *qualifications at Level 2 and below*, reflecting the prioritisation of 16-18 low-attaining students in current policy and the impact of the *condition of funding*. There are similar numbers teaching GCSE Mathematics and Functional Skills Mathematics, with some specialising in being either a GCSE or Functional Skills teacher, although many teach on both qualification courses. A minority teach A level and Core Maths, usually in conjunction with other mathematics qualifications. A larger minority teach on a range of accredited and non-accredited 'other mathematics' courses.

Out-of-class tasks take up a considerable amount of time for many FE mathematics teachers. They spend most time on assessment, planning and preparation but tracking student progress and monitoring attendance also feature strongly. The range of activities carried out shows the importance of things that are directly linked to ensuring *student compliance* with compulsory mathematics policies (e.g. attendance monitoring).

Most FE mathematics teachers spend time *liaising with vocational staff*. This is more likely to be about students than about mathematics. This indicates a high level of interaction concerning student welfare and behaviour but less communication about connecting mathematics to vocational learning. Most teachers provide *voluntary support for students*, on an individual basis or through a workshop. In some colleges, workshop teaching is part of teachers' contracted teaching hours but in others it is voluntary and additional.

The most common *professional development needs* identified by teachers are connected to issues with student behaviour (motivation, engagement, behaviour management) and subject-specific approaches to teaching. The importance to teachers of improving student engagement, motivation and behaviour shows the impact of compulsory mathematics on classrooms and the importance of having effective strategies for dealing with attitudinal and behavioural issues. Teachers' perceptions of needing to increase their understanding of mathematics-specific pedagogy are consistent with the CPD needs identified above and highlight the importance of an appropriate professional development programme planned to address the specific individual needs of mathematics teachers in FE.

Appendix

The sample for the survey was comprised of all teachers of mathematics qualifications in 31 general Further Education providers. Each provider also completed a staff audit to show the total number of teachers (during 2017/18) in each of the nine employment categories. This was used to estimate the response rate and to ascertain how well the survey responses represented the population of mathematics teachers in these colleges.

Figure 33 shows a comparison of the number of respondents in the nine employment categories compared to data from the staff audit. The survey respondents included a higher percentage that were full-time mathematics teachers (46%) than the staff audit (40%). There were less vocational (or other subject) teachers completing the survey (16%) compared to the staff audit (21%) and only 1 teacher on an agency contract compared to 11 in the staff audit. The percentages in the other categories and the overall profiles were similar.

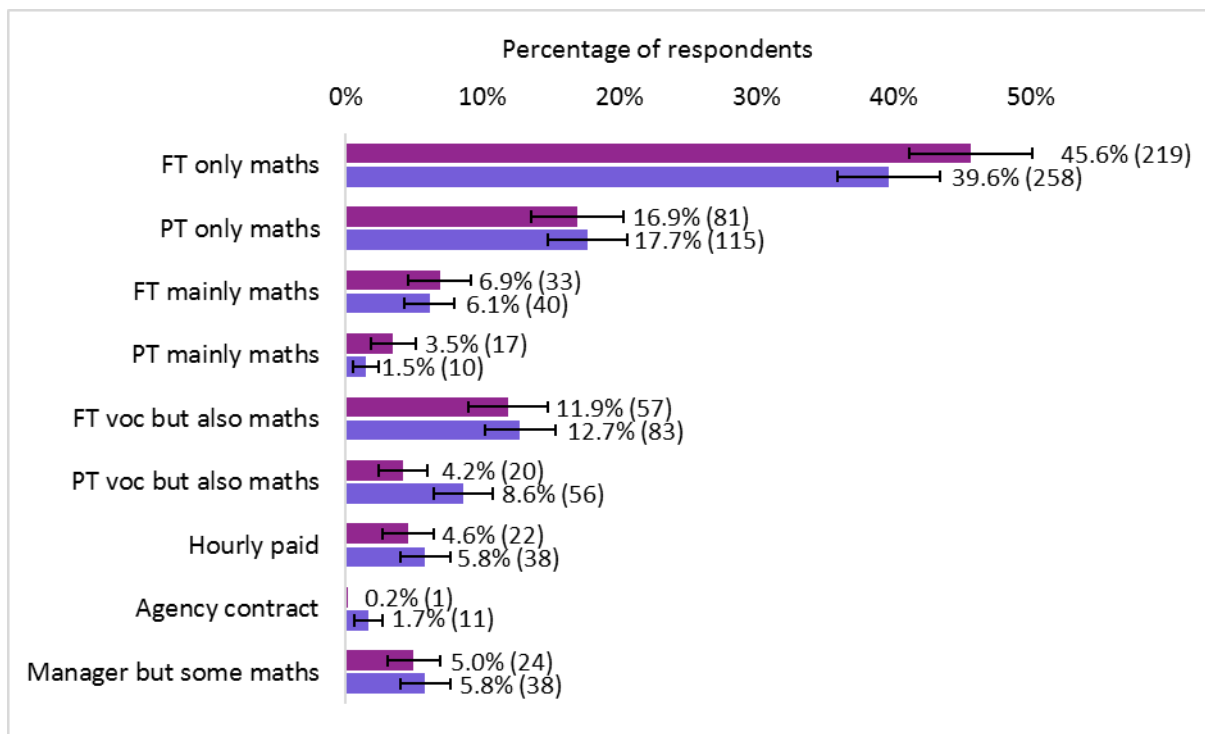


Figure 33: Comparison between the staff audit sample and the survey sample in terms of the percentage of respondents in each of the nine employment categories. Error bars show the 95% confidence intervals for the percentages within each dataset.

The temporary nature of agency staffing made it unlikely that responses could be obtained from these teachers but their contribution to the overall workforce is small. The other differences may be due to the dispersion of mathematics teachers across some colleges, which could make it more difficult to obtain responses from vocational (or other subject) staff, and the higher priority given by full-time mathematics teachers to their subject than those for whom it is a secondary teaching subject.

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