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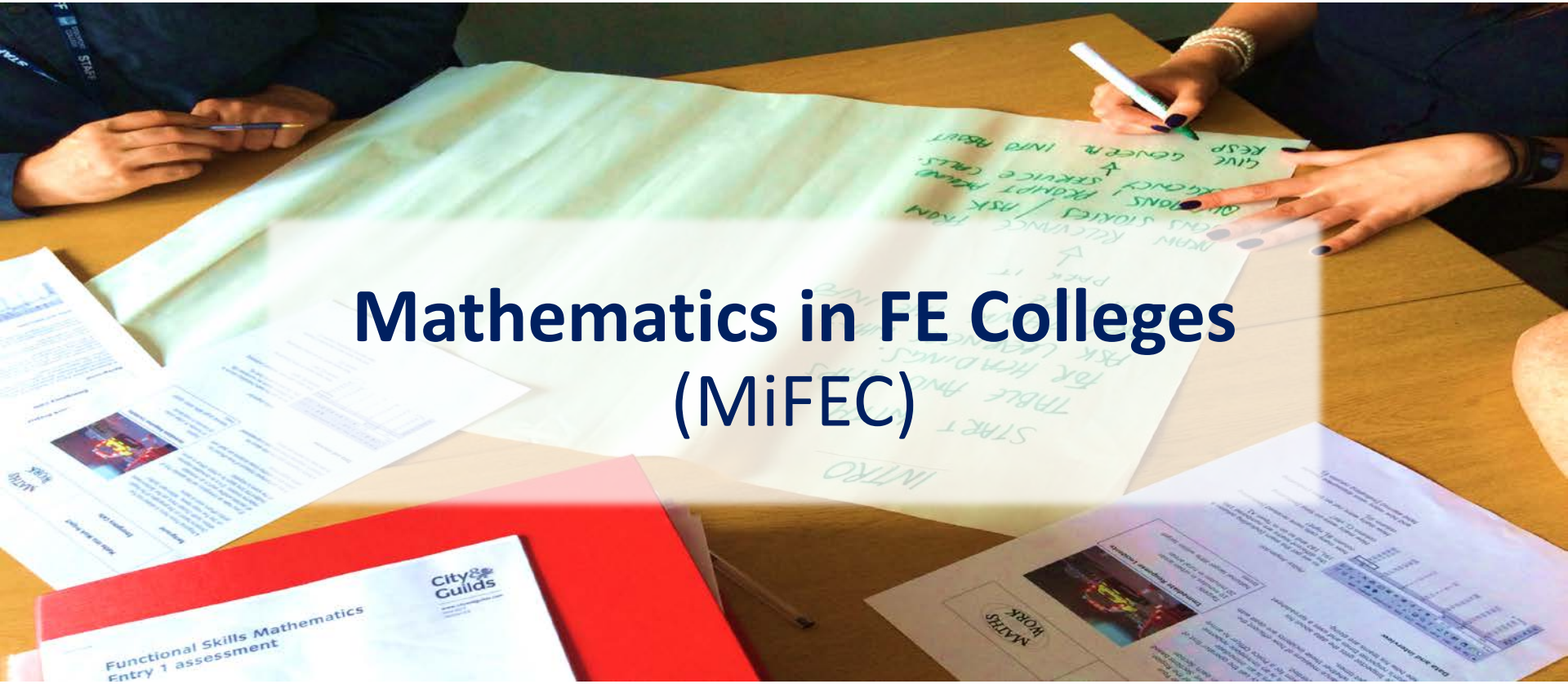
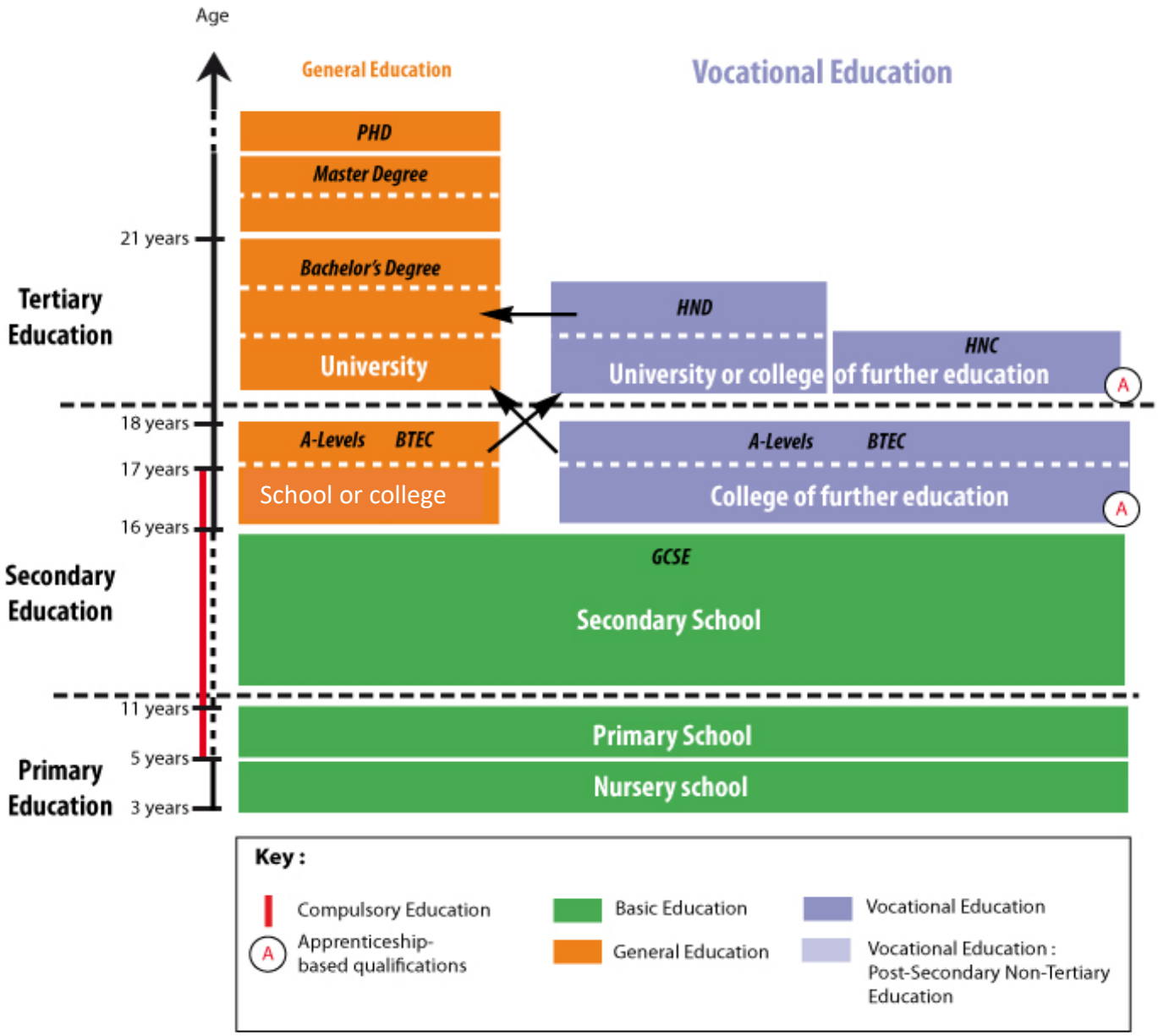


Mathematics in FE Colleges (MiFEC)

Diane Dalby and Andrew Noyes

ALM & NANAMIC conference, 10th July 2018

Education System in UK



National context

Almost half of young people in England do not attain the accepted minimum standard in mathematics (GCSE Grade C) at age 16 and three quarters of these students then enter Further Education colleges (ETF, 2014). The majority of these students follow vocational or technical pathways.

National policy

- Mathematics is compulsory for 16-18 year olds who do not attain this standard.
- Re-sitting GCSE mathematics is prioritised over taking alternative mathematics qualifications, e.g. functional mathematics.

Mathematics in FE Colleges (MiFEC)

Sept 2017 – Nov 2019

Aims

The project, funded by the Nuffield Foundation, aims to produce evidence-based advice for policymakers, college managers, curriculum leaders and practitioners on how to improve mathematics education in England's Further Education colleges. The main focus is on provision for 16-18 year old students studying mathematics at Level 2 or below.

Approach

The project uses a mixed methods research design (Tashakkori & Teddlie, 2010) to explore the complex interplay between factors that directly or indirectly affect students' mathematical trajectories and outcomes (Dalby & Noyes, 2016).

A multi scale approach (Noyes, 2013) is used to investigate:

- the national policy landscape for mathematics in FE
- patterns of student engagement over time
- college level policy enactment and curriculum implementation
- teacher workforce skills and motivations
- learning mathematics in vocational contexts.

A logic model (Funnell & Rogers, 2011) based on the theory of change is being developed to explore the key issues framing mathematics education in FE colleges.

Four research strands

Strand 1

A national policy trajectory analysis and literature review.

Strand 2

Analyses of student progression over time (using the ILR and Next Steps survey).

Strand 3

Six main case studies of colleges in 2017/18.

24 additional college case studies in 2018/19.

Strand 4

A survey of the mathematics workforce in FE colleges.

Strand 1: Policy trajectory and literature

1. How has FE mathematics policy and practice been shaped since c. 2000?
2. What lessons can be learnt to improve the design of policy in the future?

Emerging issues

- Reports that have influenced mathematics in FE include some about general aspects of FE as well as those specifically about 16-18 mathematics or adult mathematics.
- Funding, governments and ministers are also factors for consideration.
- The origins of influential reports (government or independent) vary over time.

Government	Conservative: John Major; Labour: Tony Blair (May 1997)	Labour: Tony Blair	Labour: Tony Blair	Labour: Tony Blair	Labour: Tony Blair	Labour: Tony Blair	Labour: Tony Blair	Labour:
Secretary of State for Education	Gillian Shephard/David Blunkett (May 1997)	David Blunkett	David Blunkett	David Blunkett	David Blunkett/Estelle Morris (June 2001)	Estelle Morris/Charles Clarke (Oct 2002)	Charles Clarke	Charles Clar (Dec
Legislation and consultation	1996 July Education Act			2000 Learning and Skills Act	2001 White Paper, Schools: Achieving Success	2002 Education Act	2003. Green Paper, 14-19: Opportunity and excellence.	
	1997 Education Act					2002 Green Paper, 14-19: Extending opportunities, raising standards.	2003 July White paper 21st century skills: realising our potential	
Government reports: general & mathematics	*1996 March. Dearing. Review of Qualifications for 16-19 Year Olds*	1997 June Kennedy Learning works: widening participation in further education.		1999. Moser. Improving literacy and numeracy: A Fresh Start	2001. DfEE. Skills for Life: The National Strategy for Improving Adult Literacy and Numeracy Skils	2001 DfES Patterns of Participation in full-time education after 16	2003 DfES Payne Vocational pathways at age 16-19	2004. Februa Making Mat Count (post-
		1997 DfEE Announcement of Investing in Young People: aiming to increase participation in post-16 education			2001 Aim Higher Initiative introduced	2002 June DfES Success for All - discussion document	2003 DfES Skills for Life focus on delivery to 2007	2004. Octob 14-19 Curric Qualificatio
							2003 Skills for Success - what the skills strategy means for business	2004. DfES. Success
							2002 November DfE Success for All - vision for the future	
Other reports: general & mathematics		1998 January FEFC Key Skills in FE: good practice report		2000 Ofsted & FEFC & TSC. Pilot of new key skills qualifications.				2004 Januar Regional var adult and vo learning

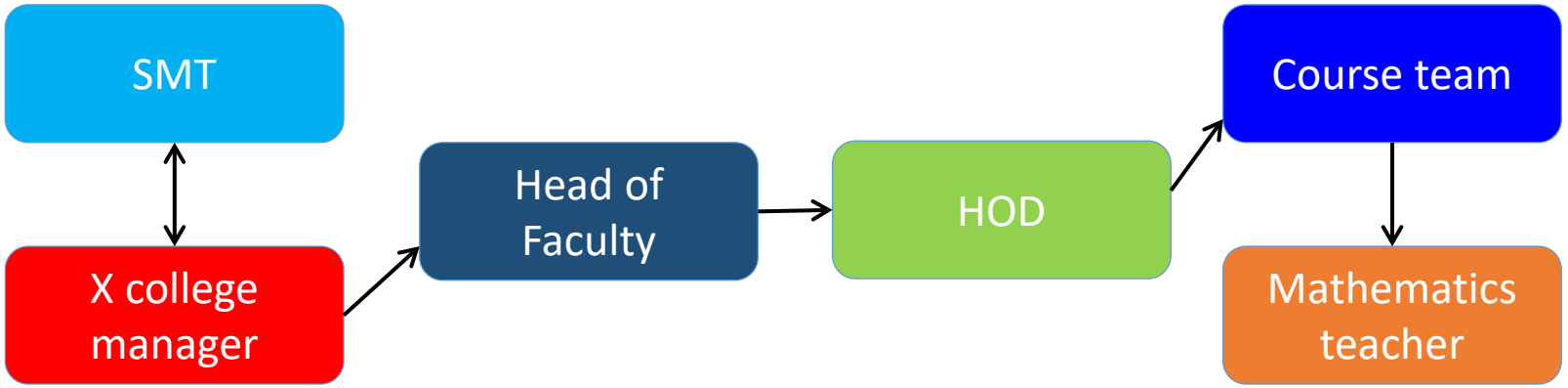
Policy analysis

Possible themes for analysis:

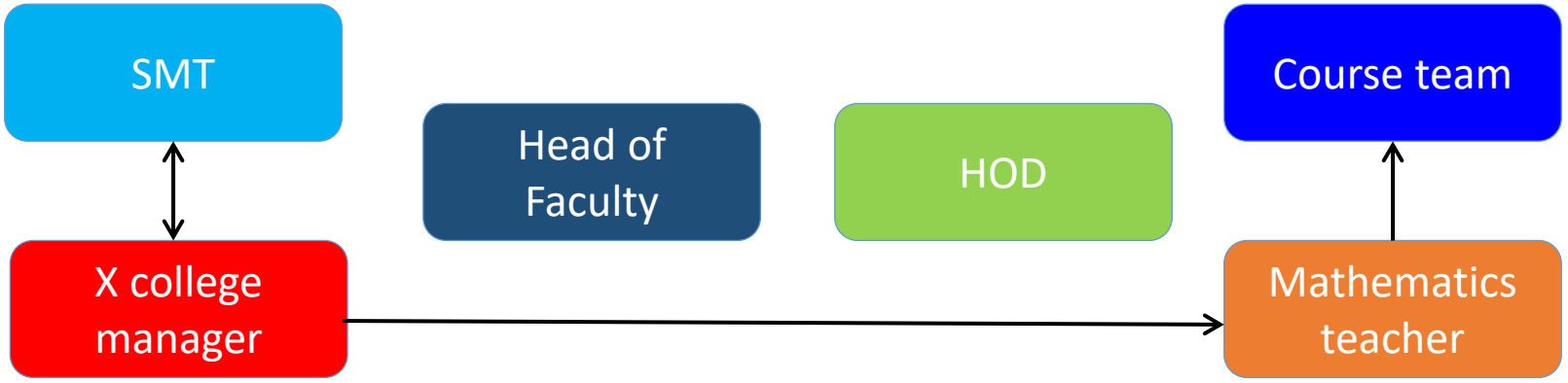
1. The development of the concepts of mathematics for all and/or mathematics for life and work.
2. The use of incentives and disincentives in the implementation of mathematics for all and/or mathematics for life and work.
3. The coupling and recoupling of mathematics with other qualifications, vocational and academic.

Examples of policy enactment

Example 1 (See Ball, Maguire & Braun, 2014; Dalby & Noyes, 2018)



Example 2



Strand 2: Student progression

1. Who attains what mathematics qualifications in FE and how has this changed over time?
2. What are the relationships between prior attainment, FE mathematics outcomes and life experiences at age 25?

Emerging issues

- Good data is potentially available from NPD, ILR and Next Steps but there are some challenges, e.g. changes in variables within the ILR over time.
- Obtaining access is becoming increasingly more difficult.
- A cohort approach helps understand changes over time.

National data

The National Pupil Database (NPD) provides baseline GCSE and social data.

The Individualised Learner Record (ILR) is linked, for the following three years, for each GCSE cohort.

NPD base data	ILR data								
GCSE year	2008	2009	2010	2011	2012	2013	2014	2015	2016
2006	Next Steps Survey cohort								
2007									
2008									
2009									
2010									
2011									
2012									
2013									

Examples of student pathways

Example 1: (2012-14) Student on Public Services course (Level 3)

Year in FE	1	2	3
Mathematics studied	Level 1 functional mathematics	Level 2 functional mathematics	GCSE mathematics

Example 2: (2016-18) Student on Animal Care course (Level 1)

Year in FE	1	2	3
Mathematics studied	Entry level functional mathematics	Level 1 functional mathematics	(GCSE mathematics)

- Changes in government and college policies have significant effects on students' post-16 mathematics pathways.

Strand 3: College case studies

1. How do FE colleges mediate post-16 mathematics policy?
2. What different strategies have been employed?
3. How has/is funding shaping college policy and classroom experience?
4. What are the workforce strengths and limitations?
5. How is curriculum and assessment changing?
6. What are the unintended consequences of policy upon classrooms?

Emerging issues

- The frequency of college mergers, internal re-structures and changes in college management present operational challenges for research projects.
- A number of key themes are emerging that will discussed later in the agenda.

Main case studies

- Visits to 6 main case study providers (8 colleges), in 6 different regions
- 14 days of visits across the country
- A further 25 providers have agreed to be case studies in 18/19.

No of colleges visited	No of sites visited	Number of interviews				
		College principals or CEOs	Senior managers	Other managers overseeing maths	Staff teaching maths	Vocational staff
8	13	6	4	17	39	14

- 73 interviews have been carried out and 23 student focus groups, involving a total of 130 students.
- Colleges have completed a staff audit, data summary and provided other documents relevant to the study.

Selection of additional cases

Criteria considered:

Region – all regions to be represented

Size – retain previous focus on large colleges

Type of provision – include vocational only providers and academic/vocational providers in each region

Maths progress measure – include a range within each region

Location – include a range within each region

Latest college Ofsted grading –include a range within each region

Approach:

- Stratified by region
- Providers arranged within region according to maths progress measure
- Systematic sampling within region to obtain an appropriate 'balanced' sample for the other criteria above (type of provision, location, Ofsted grade).

Full set of case study colleges

Region	Total number of providers in region (01/09/17)	Planned target number for sample	Providers already agreed (main case studies)	Additional providers invited (March 2018)	Replacement providers invited (May/June 2018)	Additional and replacement providers accepted	Total number of providers accepted	Number of colleges involved
E	21	3	0	3	1	3	3	3
EM	12	2	1	2		2	3	3
GL	20	3	1*	3		1	2*	5
NE	14	3	0	3	1	3*	3*	3
NW	31	4	1	4		4	5	5
SE	31	4	1	3		3	4	4
SW	19	3	0	3	1	3	3	3
WM	21	3	1	3	3	4*	5*	11
YH	18	3	1	2	1 +3	2	3	3
Total	**187**	**28**	**6***	**26**	**10**	**25**	**31**	**40**

Emerging theme 1

A trend away from Functional Mathematics towards GCSE.

The main driver for this is the growing importance of the mathematics progress measure, as opposed to a singular focus on percentages crossing the Grade 4 threshold.

This is compounded by the increased difficulty of Level 2 Functional Mathematics and its unsuitability as a stepping stone to GCSE. There is concern, however, about students experiencing multiple failures with more colleges moving to enter those having attained Grade 1 and 2 for GCSE mathematics rather than taking functional mathematics.

Emerging theme 2

(In)stability in the college mathematics teacher workforce

Many colleges have difficulty recruiting mathematics teachers but those with effective strategies to achieve workforce stability see multiple benefits:

- Stable workforces can develop collective approaches to planning;
- CPD has clearer, sustained effects on quality;
- Students respond negatively to changes in staffing and value continuity.

Current strategies to achieve stability include financial incentives and 'grow your own' schemes, in which staff from other college areas (e.g. vocational, student support) are re-trained to teach mathematics.

Emerging theme 3

A whole college responsibility approach

Mathematics provision seems to be more effective when:

- senior managers are actively involved, investing time and financial support to overcome problems;
- where vocational areas share responsibility for mathematics provision, e.g. by encouraging embedded approaches and taking an active role in monitoring attendance.

Emerging theme 4

A need for better-informed decision-making using robust, meaningful and relevant data.

Many colleges take a ‘try it and see’ approach towards:

- strategic decision-making for mathematics provision;
- choices concerning teaching and learning.

Relevant data to inform decisions is often either not readily available, or not considered.

Colleges who routinely collect meaningful data and use it to inform their decisions have more confidence that their approach is meeting student needs. Whether this leads to more effective strategies and outcomes will be explored through further analysis of available data.

Emerging theme 5

Tensions between teacher-centred and student-centred approaches.

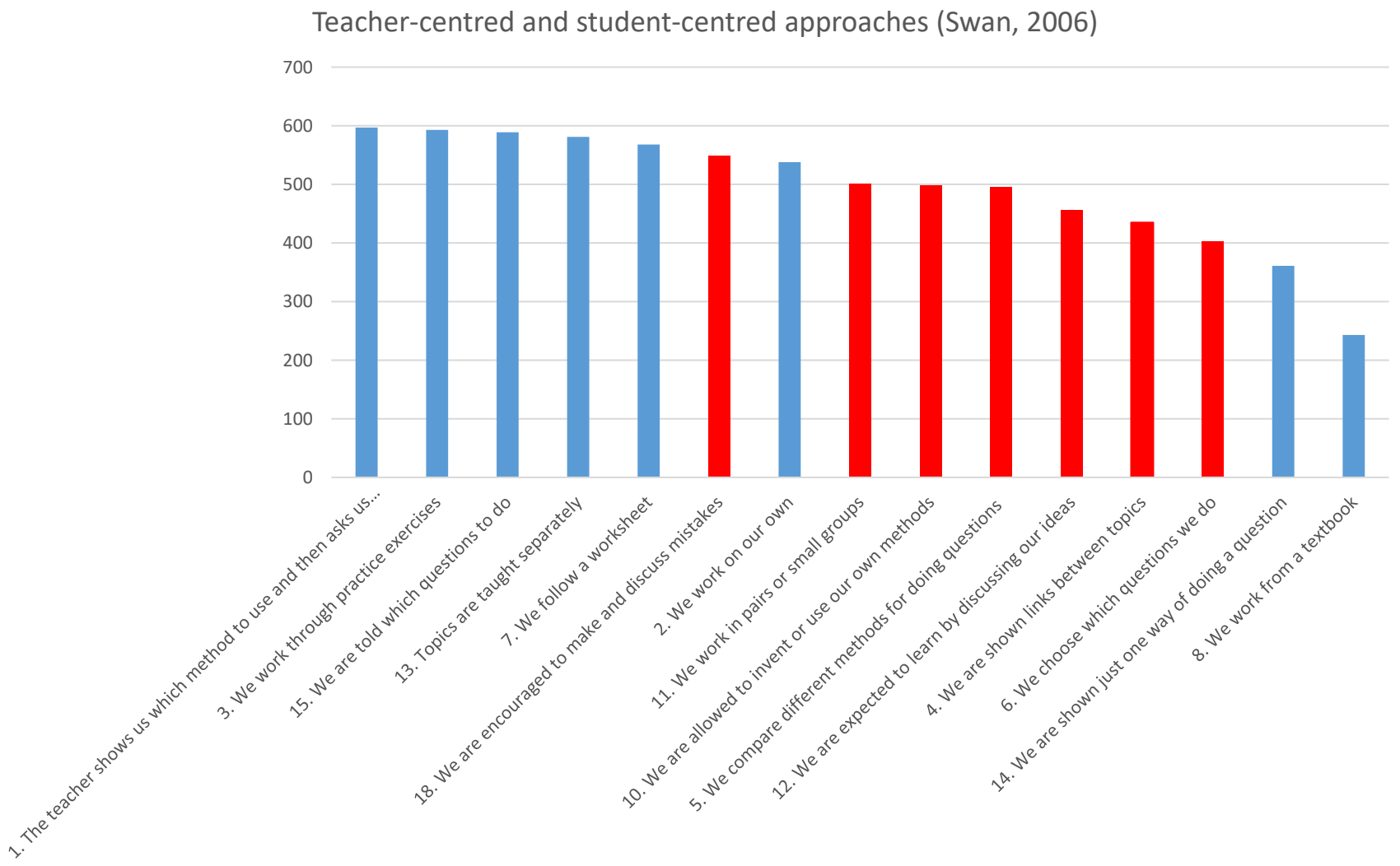
Mathematics teachers consistently identify students' needs as both cognitive and affective, highlighting:

- The need to engage and motivate students.
- The need to help students develop more positive attitudes to mathematics, overcome anxiety and build confidence.
- The need to develop sound conceptual understanding and fluency with basic mathematical operations.
- The need to develop good examination techniques.

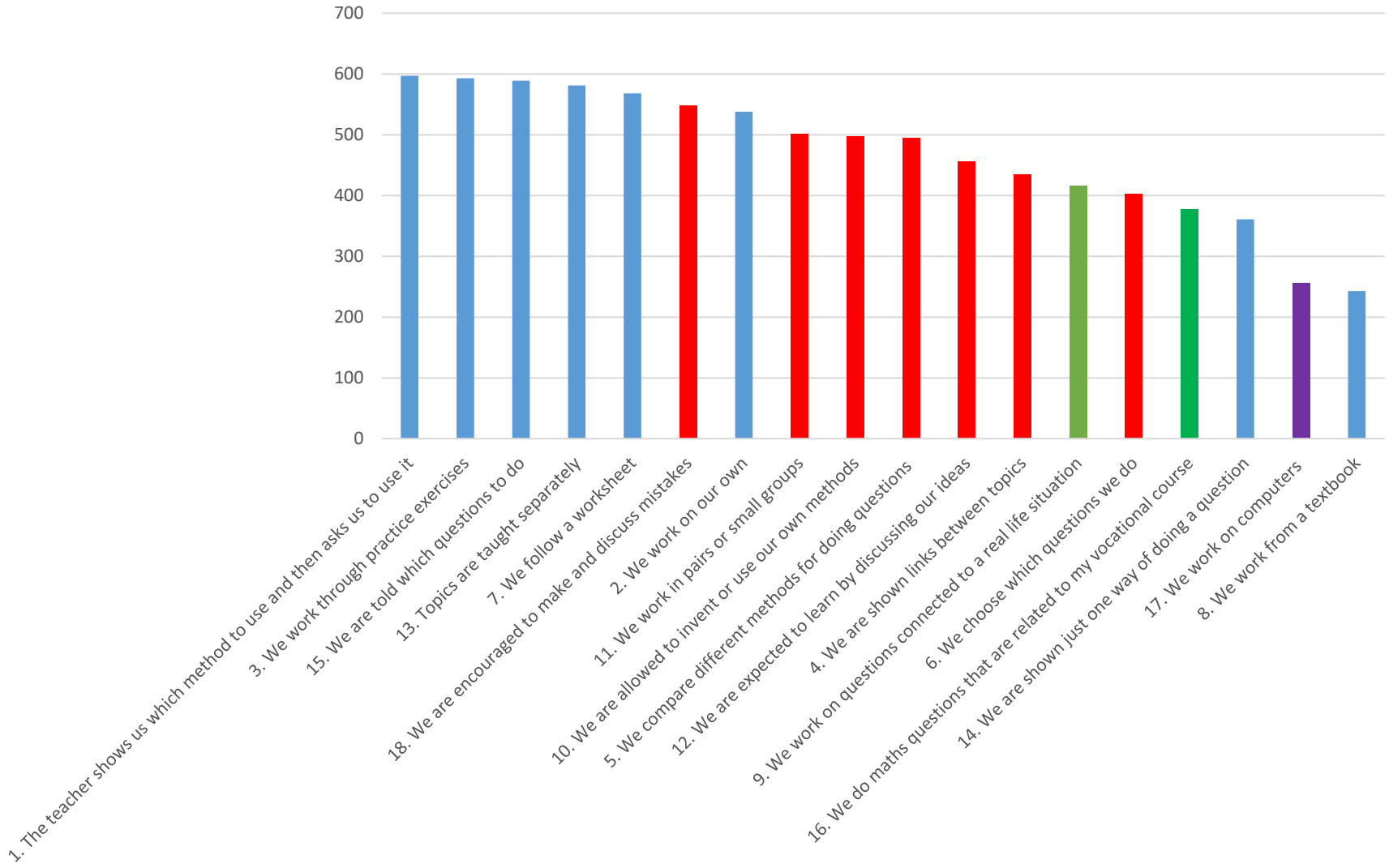
Discrepancies between these identified needs and student perceptions of classroom teaching are evident. Students' views suggest much teaching is teacher-centred.

This mismatch may be attributed to multiple contextual factors that affect teachers' decisions, and the transience of the teacher workforce.

Teacher-centred or student-centred?



Mathematics lessons: students' views



1. The teacher shows us which method to use and then asks us to use it
2. We work on our own
3. We work through practice exercises
4. We are shown links between topics
5. We compare different methods for doing questions
6. We choose which questions we do
7. We follow a worksheet
8. We work from a textbook
9. We work on questions connected to a real life situation
10. We are allowed to invent or use our own methods
11. We work in pairs or small groups
12. We are expected to learn by discussing our ideas
13. Topics are taught separately
14. We are shown just one way of doing a question
15. We are told which questions to do
16. We do maths questions that are related to my vocational course
17. We work on computers
18. We are encouraged to make and discuss mistakes

Discussion 1: Approaches to teaching and learning

What are the benefits of using:

- Teacher-centred approaches
- Student-centred-approaches
- Connected approaches
- Digital technology

Think especially about students with the needs identified earlier:

- The need to engage and motivate students.
- The need to help students develop more positive attitudes to mathematics, overcome anxiety and build confidence.
- The need to develop sound conceptual understanding and fluency with basic mathematical operations.
- The need to develop good examination techniques.

Strand 4: Mathematics teacher workforce

1. Who is teaching post-16 maths in FE now? (to include roles, responsibilities, knowledge and skills).
2. What FE mathematics training and development needs exist now and will be needed in the short to medium term?

Emerging issues

- Little reliable national data
- Transient workforce so difficult to capture.
- Pathways into teaching mathematics in FE colleges are very varied.
- There is a lack of existing data on several issues, including the reasons why people are teaching mathematics in FE colleges and how long they intend to stay.

Survey of mathematics teachers in FE

General background: some general background data will be requested including gender, age group and mode of employment.

Teaching experience: pathways into teaching mathematics in FE colleges; professional experience; general teaching experience; specific mathematics teaching experience; previous employment and reasons for becoming a mathematics teacher in FE.

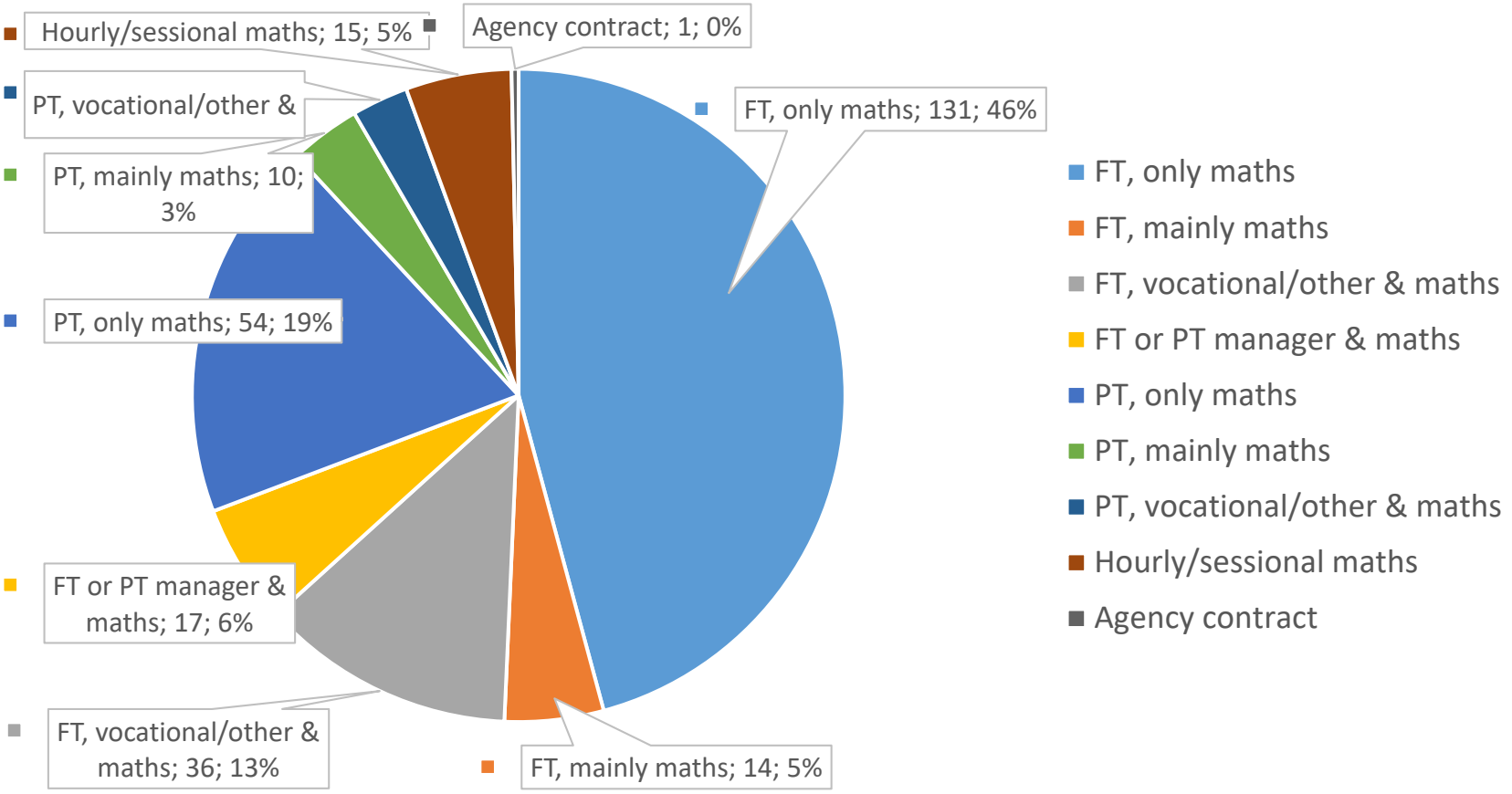
Teachers' roles and responsibilities: teaching hours; additional responsibilities and the key elements of daily work.

Changes over time: changes in employment; expected changes in workload and employment; teacher satisfaction.

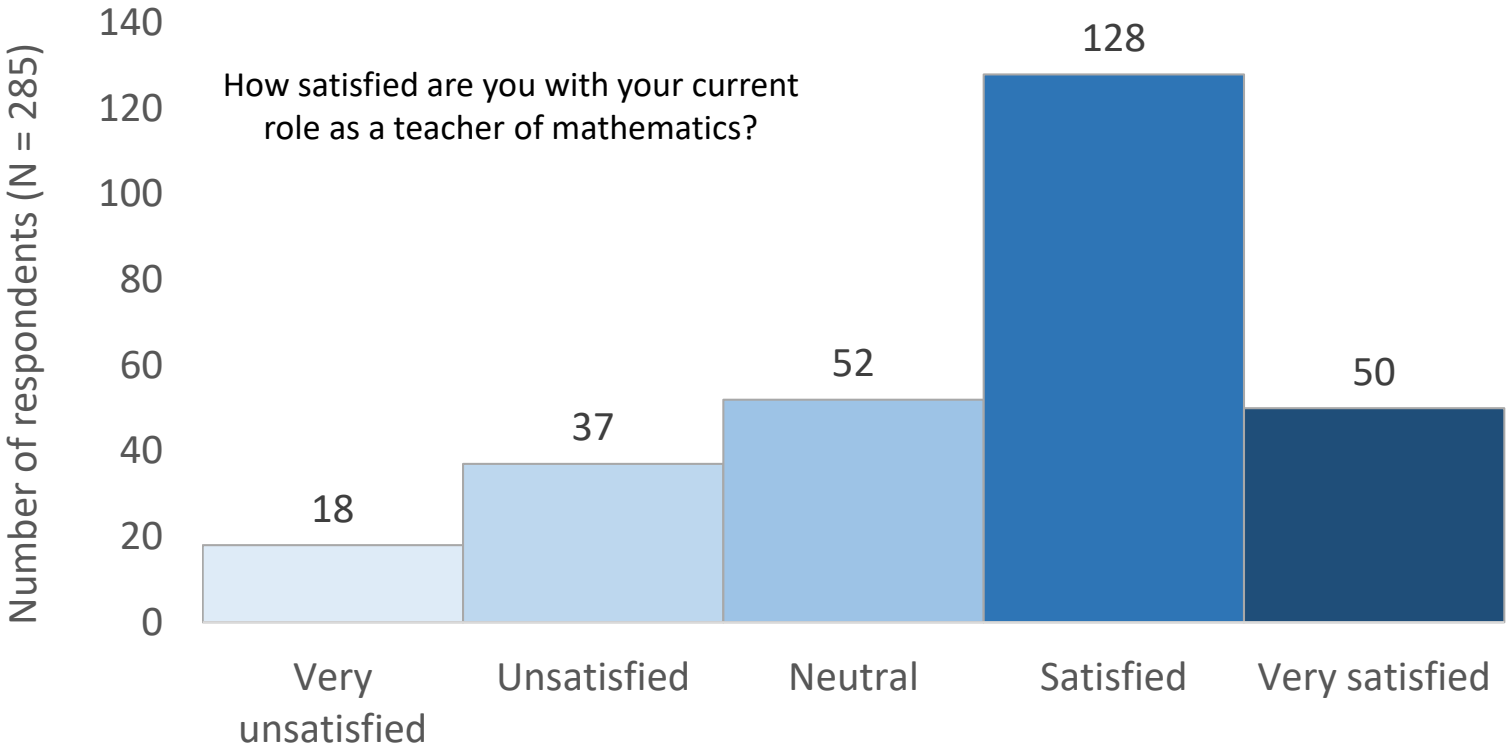
Training and PD: teachers' mathematics qualifications, teaching qualifications; professional development; possible skills needs.

Main employment

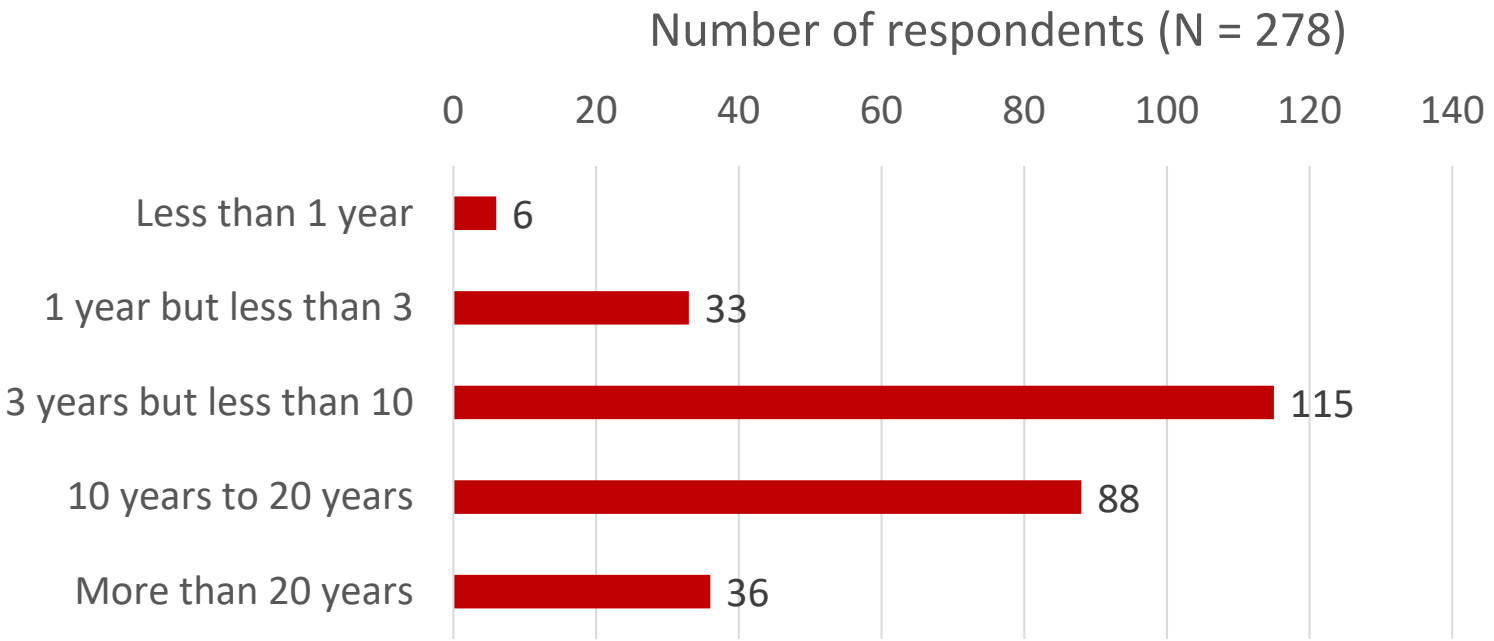
Which category best describes your main employment at this college?



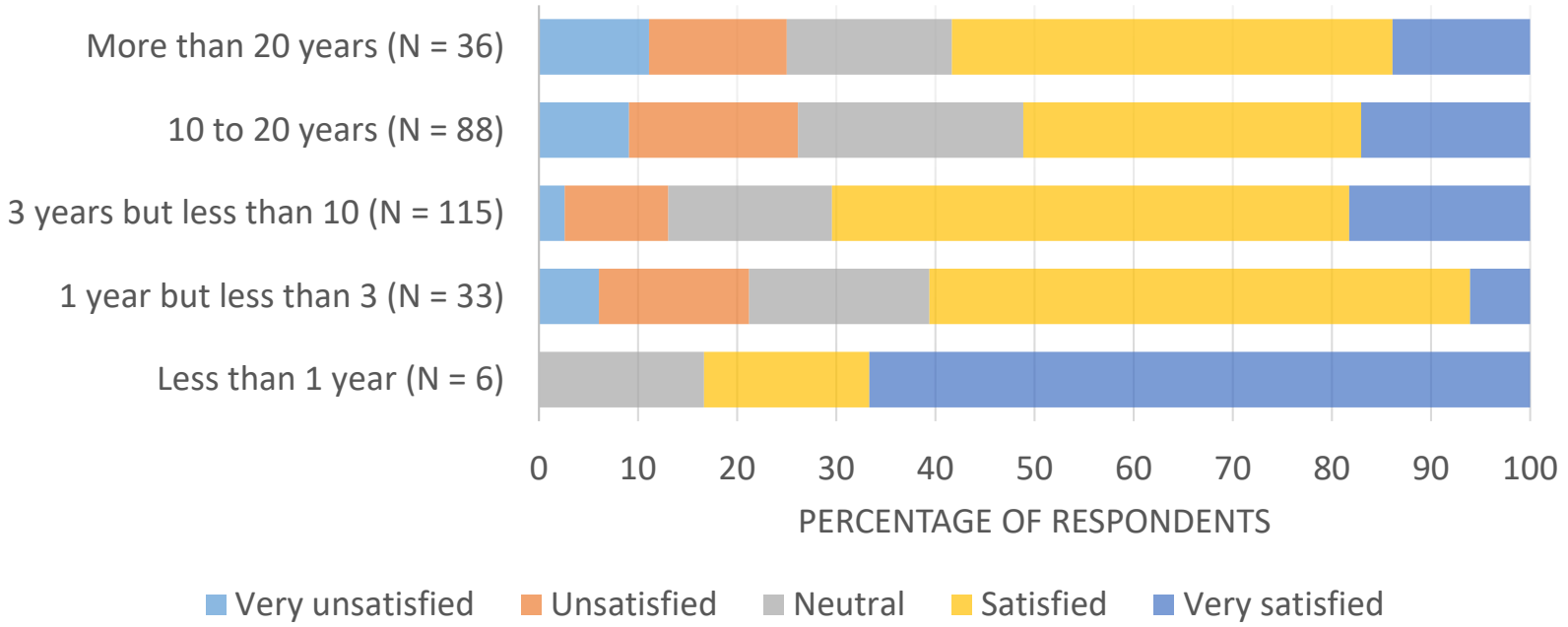
Satisfaction with current role



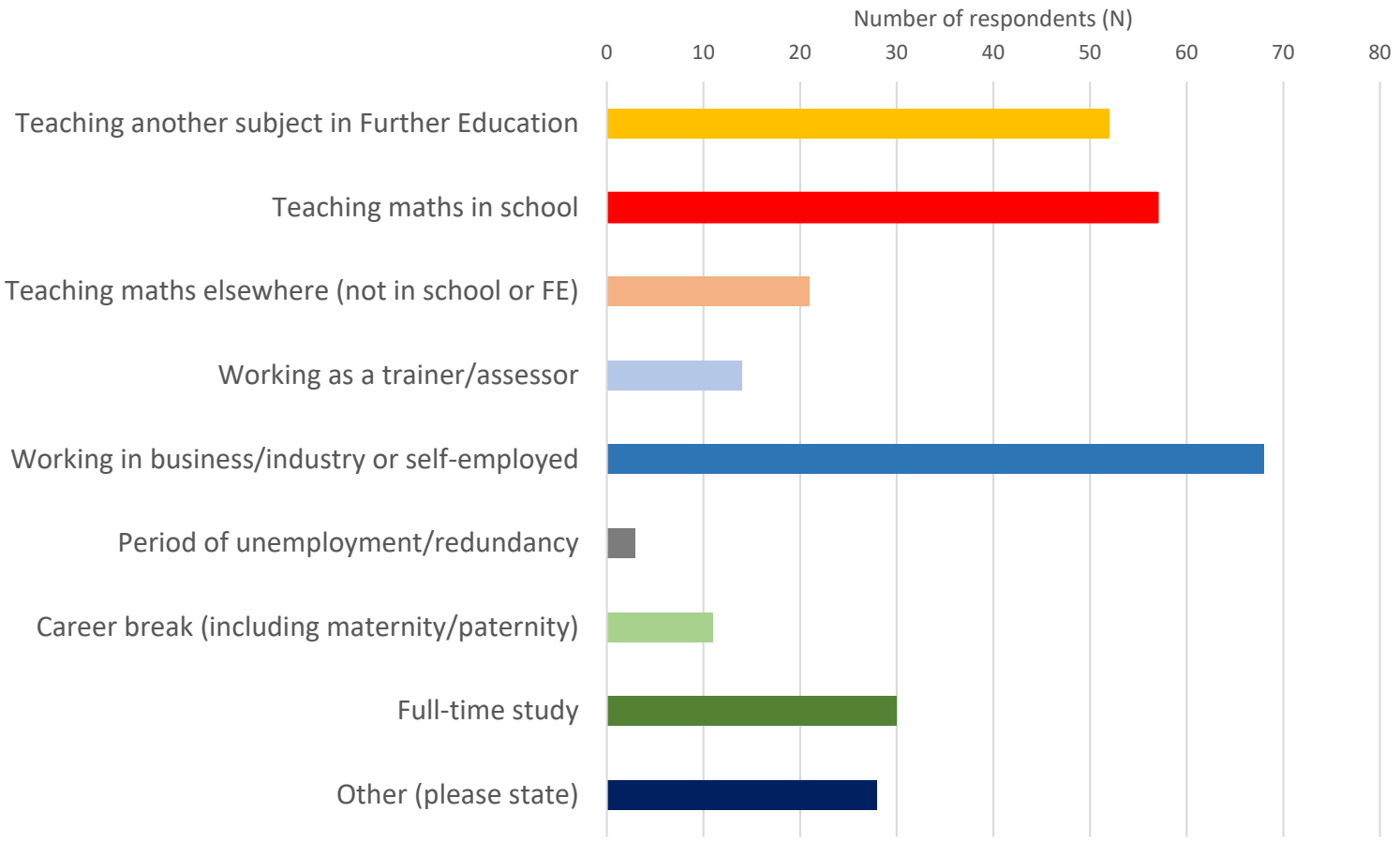
Length of service as a mathematics teacher



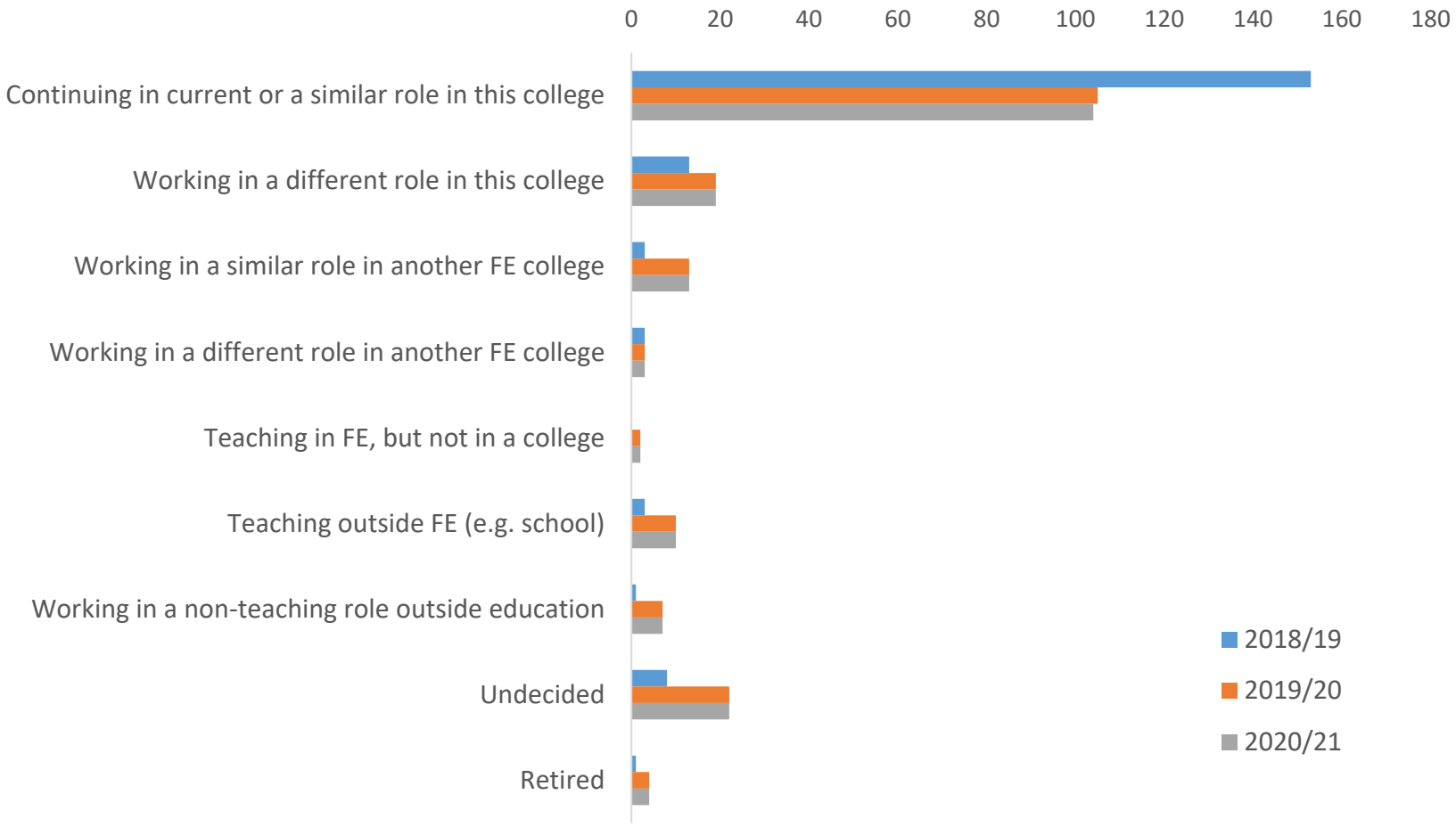
Satisfaction by length of service as a maths teacher



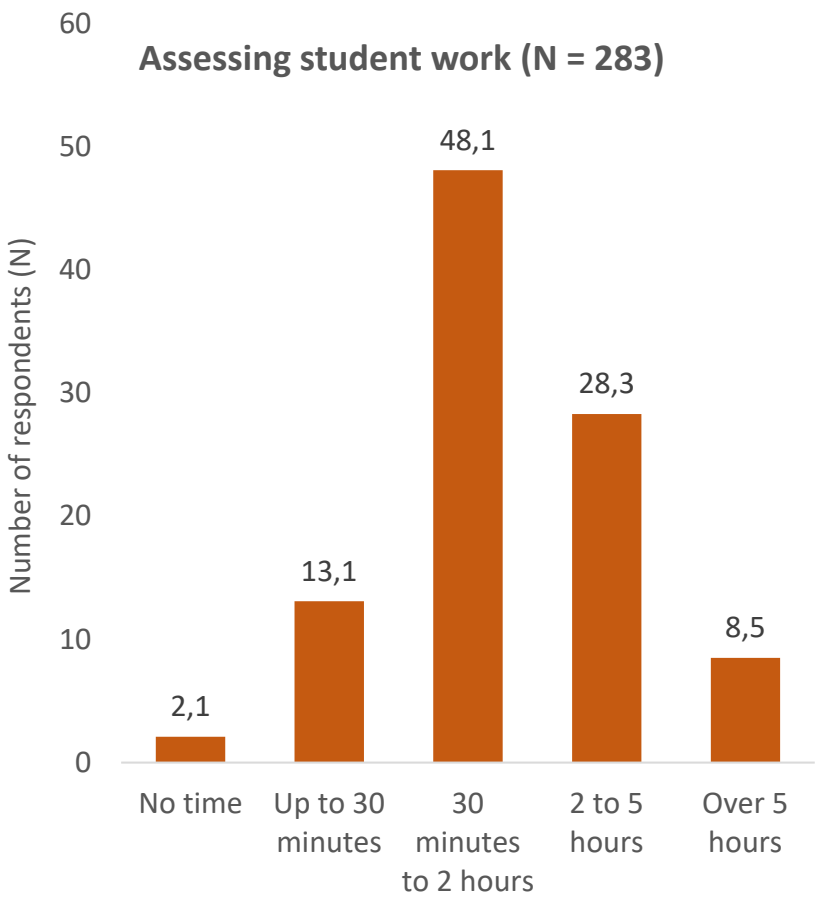
Previous work situation

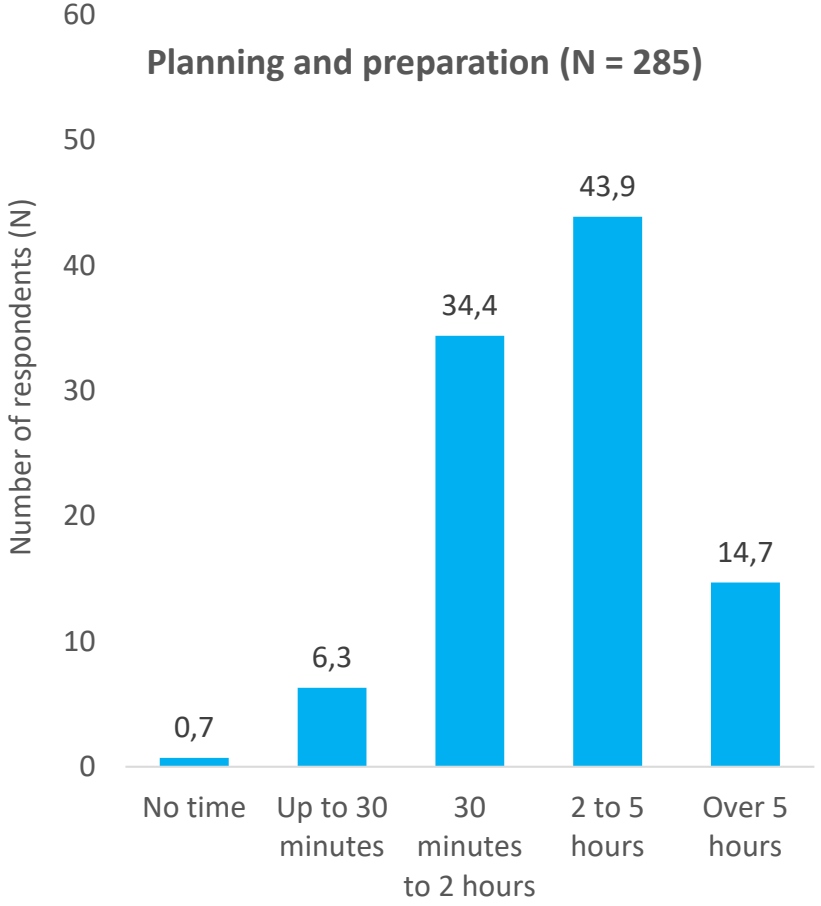


Expected work situation next 3 years

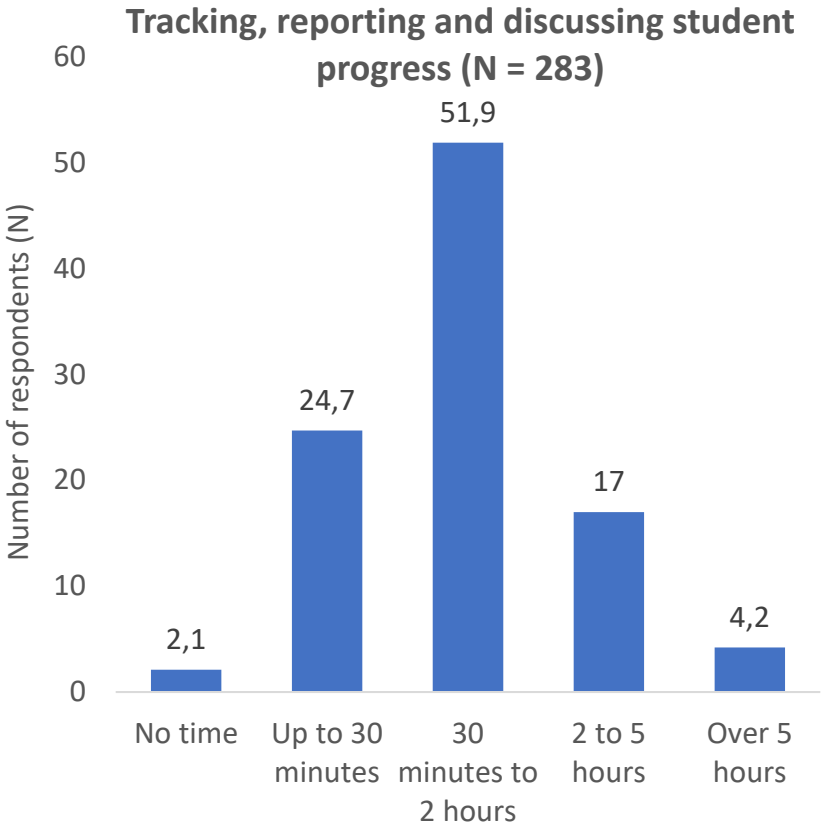


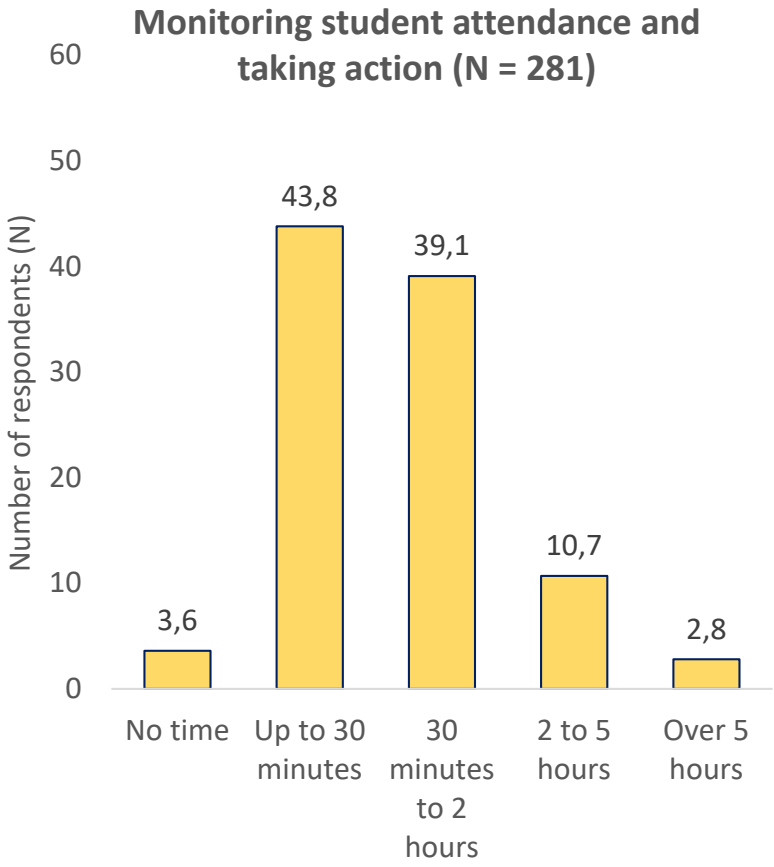
Use of non-contact hours (hrs per week)





Use of non-contact hours (hrs per week)





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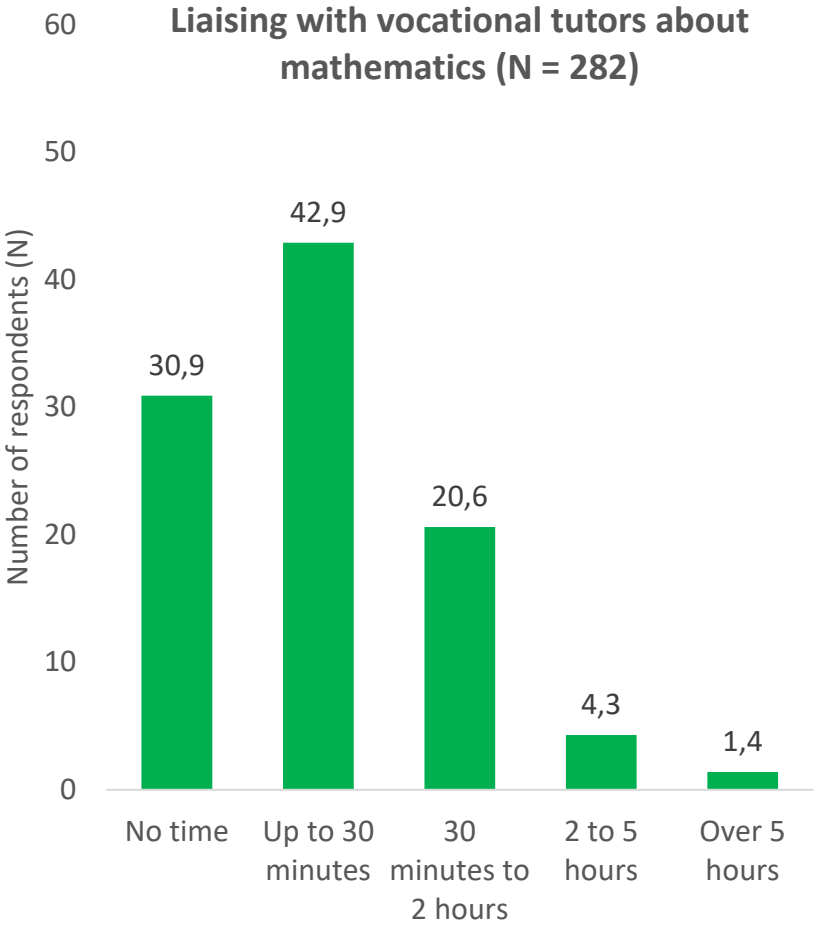
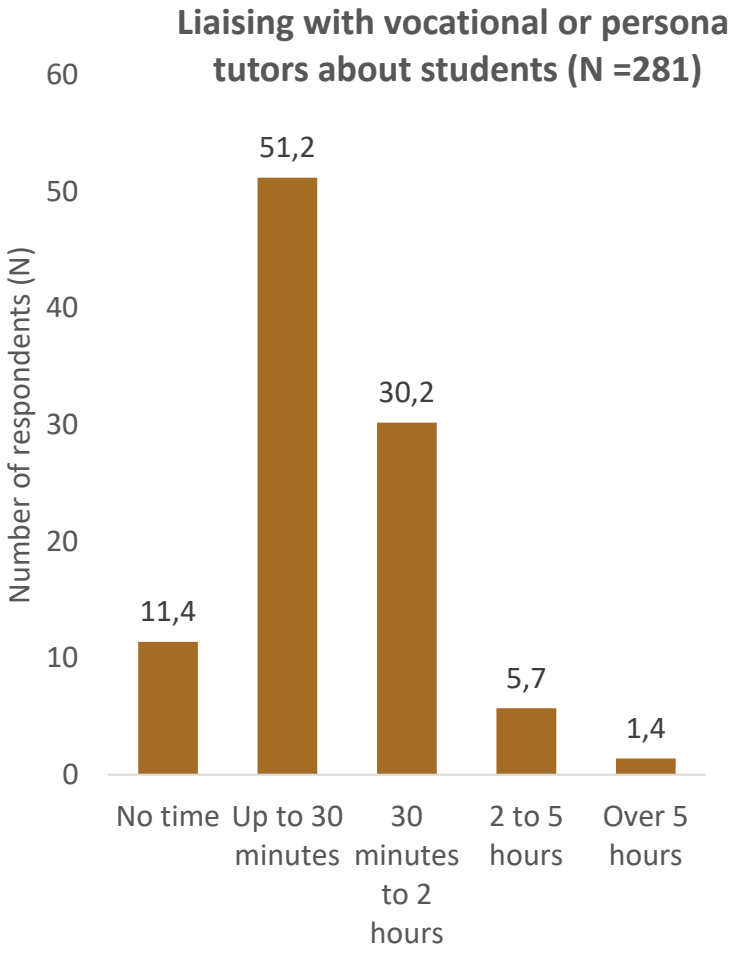
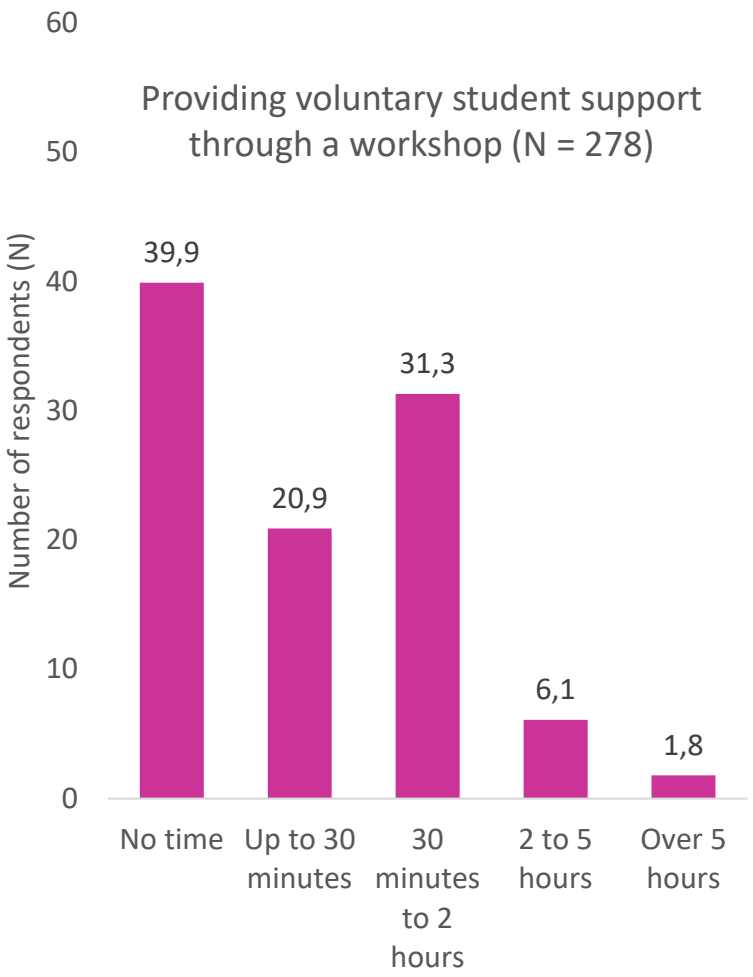
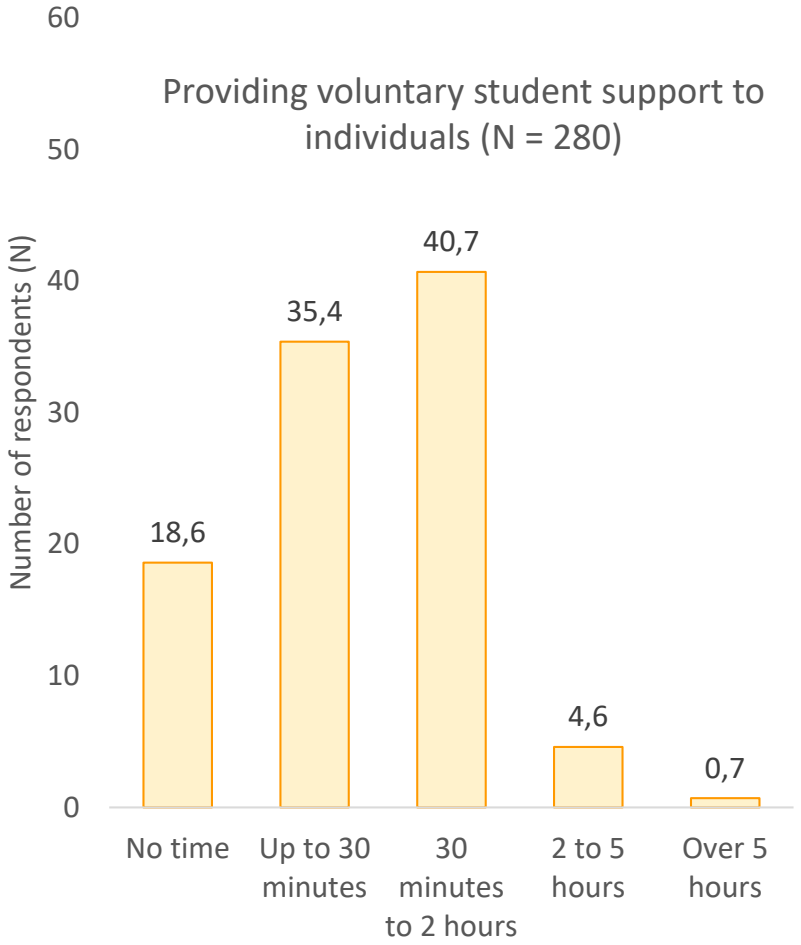




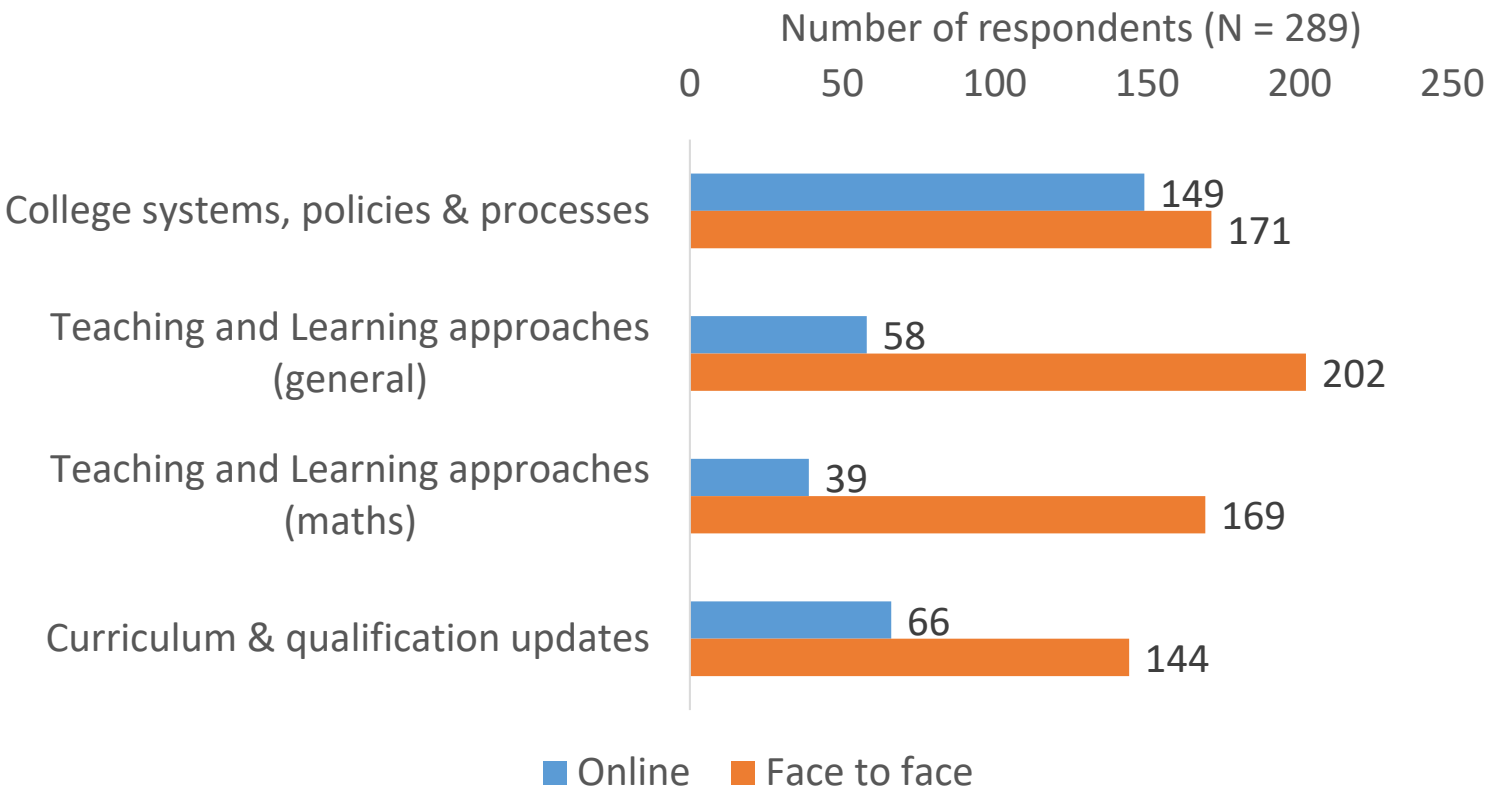
Use of non-contact hours (hrs per week)





CPD sessions or courses

During this 2017/18 academic year, will you have undertaken CPD sessions or courses (face-to-face or online) in any of the following areas?



Discussion 2: Change over time

Think about the changes you have experienced over the last 5 years and the training or professional development (CPD) you have received. Can you identify key events in the following three areas:

1. Personal changes (e.g. job, role)
2. Changes in college and policy (e.g. college structures, strategies, government directives, funding, accountability and performance measures).
3. Training and CPD related to these changes.

Try to construct a timeline to show where key changes and training/CPD have occurred for you and add any connections or comments on the impact.

Example

	2012/13	2013/14	2014/15	2015/16	2016/17
PERSONAL	Teaching Performing Arts	Started teaching one session a week of functional maths.	Increased this to 4 sessions.		Full timetable of maths, mainly GCSE. Change of college team and site.
COLLEGE		College restructuring. Students without grade C had to continue studying maths.	College changed functional maths exam board.	College merger announced. Threat of redundancy.	GCSE re-sit compulsory for grade D students
Training/CPD	Took part in embedding maths project.		Took specialist teaching qualification. CPD on behavior management and new exam board specs.	Did additional training to start teaching GCSE.	One day course on developing resilience

College short of maths teachers

Better chance to learn from colleagues

Influenced decision to train for GCSE maths

Big increase in GCSE numbers, larger classes, more behavior issues

Had more problems with my classes so needed this

Not much different but took up a lot of time

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Further information about the project is available at http://www.nottingham.ac.uk/research/groups/crme/projects/mifec/index.aspx

or from

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