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A photograph of a workshop or meeting. Two people are seated at a wooden table. One person is writing on a large sheet of paper with a green marker. The paper has handwritten notes in green ink, including 'INTRO', 'START', 'TABLE AND...', 'FOR HAND...', 'ASK LE...', 'MEAN RELEVANCE FROM', 'GIVE STORIES / ASK', 'QUESTIONS / REPORT', 'KEEP GENDER INFO ABOUT'. There are also printed documents on the table, one of which is a 'Functional Skills Mathematics Entry 1 assessment' from City & Guilds. The overall scene is brightly lit, suggesting an indoor setting.

Mathematics in FE Colleges (MiFEC)

Andrew Noyes and Diane Dalby

MEI conference, 30th June 2018

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.

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 approach 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?

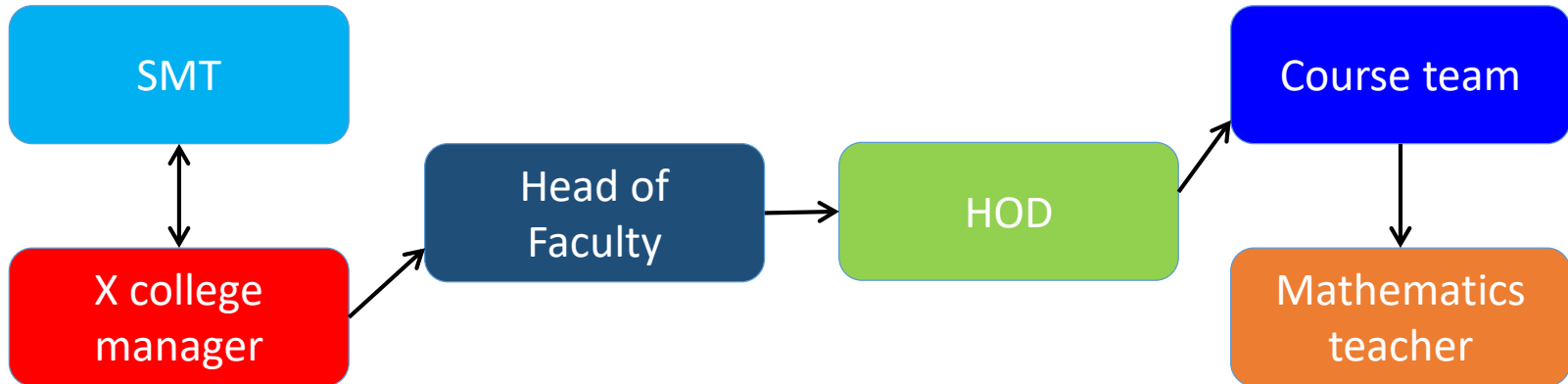
Emerging issues

- 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 Clarke (Dec 2002)
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 Skills	2001 DfES Patterns of Participation in full-time education after 16	2003 DfES Payne Vocational pathways at age 16-19	2004. February. Making Mathematics Count (post-16)
		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. October. 14-19 Curriculum Qualification
							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 January. Regional vocational adult and vocational learning

Examples of policy enactment

Example 1 (See Ball, MacGuire & 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 available from NPD, ILR and Next Steps but there are some challenges, e.g. changes in variables within the ILR over time.
- A cohort approach helps understand changes over time.

NPD/ILR

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.

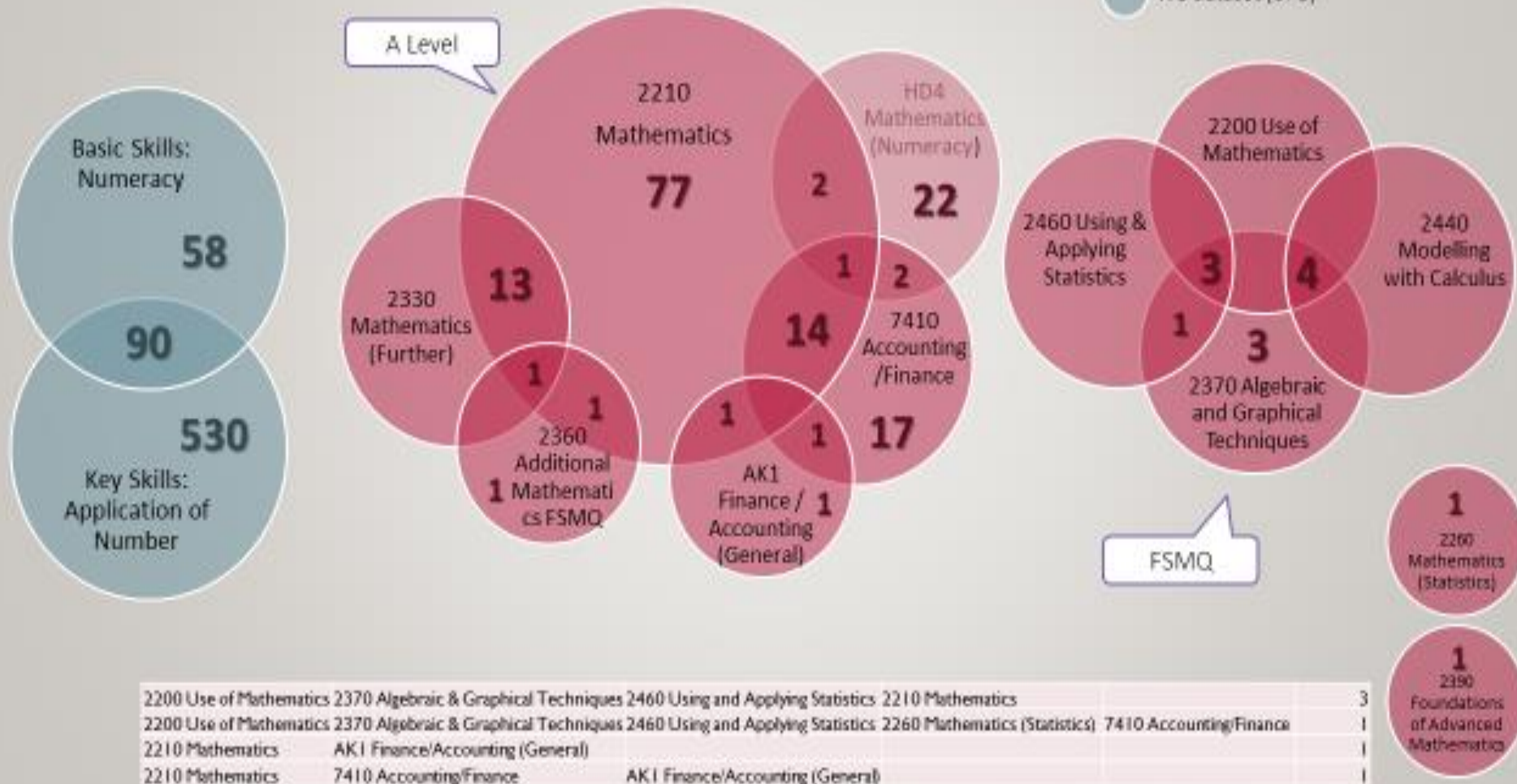
NPD base data	ILR data								
GCSE year	2008	2009	2010	2011	2012	2013	2014	2015	2016
2006	Next Steps Survey cohort								
2007	■	■	■						
2008		■	■	■					
2009			■	■	■				
2010				■	■	■			
2011					■	■	■		
2012						■	■	■	
2013							■	■	■

Next Steps survey data



Who is doing what maths at age 17/18

KS5 dataset (172)
WS dataset (678)





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 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

- There is little existing reliable national data on the FE mathematics teacher workforce.
- Pathways into teaching mathematics in FE colleges are very varied.
- The reasons why people are teaching mathematics in FE colleges and how long they intend to stay are unclear.

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.

Discussion 1: Professional development

We are interested in the impact of professional development (including teacher training courses) on mathematics teachers and students.

Try completing the survey questions provided and discuss:

1. What professional development or training has had the most impact on you and your teaching in the last 5 years?
2. **Why** has this been effective?



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.	Better chance to learn from colleagues	Full timetable of maths, mainly GCSE. Change of college team and site.
COLLEGE	College short of maths teachers	College restructuring. Students without grade C had to continue studying maths.	College changed functional maths exam board.	College merger announced. Threat of redundancy. Influenced decision to train for GCSE maths	GCSE re-sit compulsory for grade D students. Big increase in GCSE numbers, larger classes, more behavior issues
Training/CPD	Took part in embedding maths project.	Had more problems with my classes so needed this	Took specialist teaching qualification. CPD on behavior management and new exam board specs.	Did additional training to start teaching GCSE. Not much different but took up a lot of time	One day course on developing resilience

Discussion 2: CPD and 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.

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?

Main case studies

- Visits to six main case study providers (8 colleges)
- 14 days of visits across the country
- A further 24 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.

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:

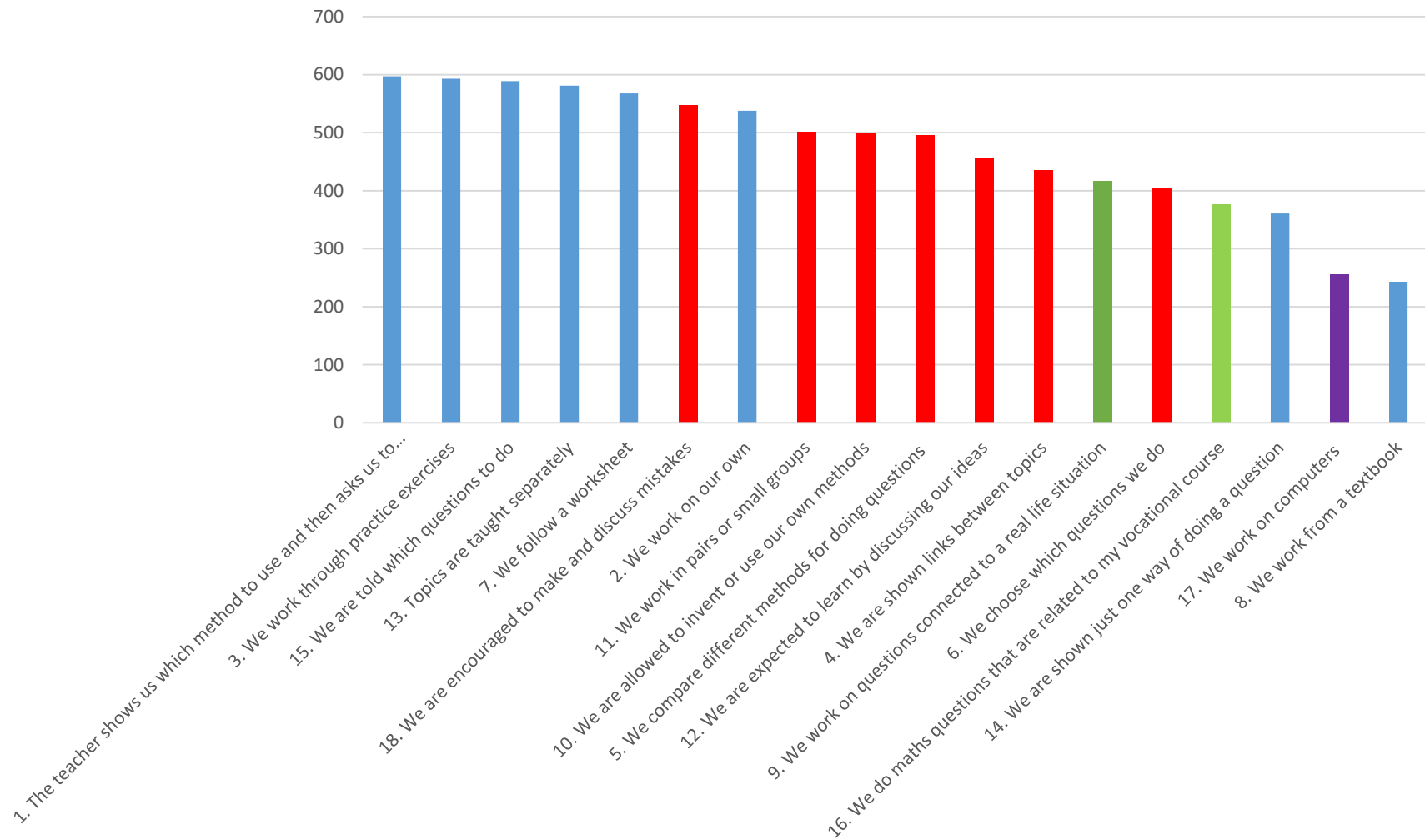
- The need to engage and motivate students.
- The need to help students develop more positive attitudes to mathematics, overcome anxiety and build confidence.
- The need to develop sound conceptual understanding and fluency with basic mathematical operations.
- The need to develop good examination techniques.

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.

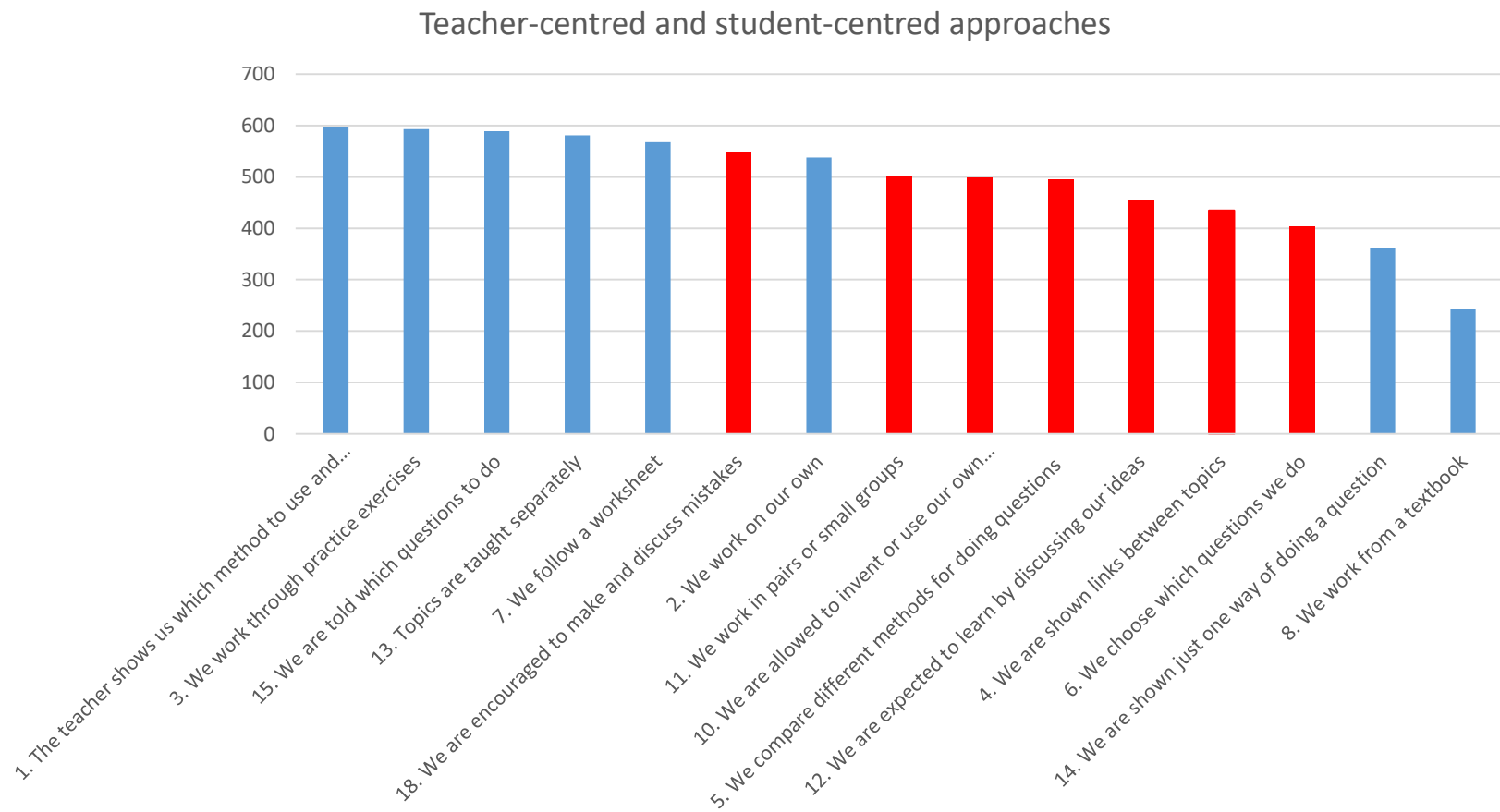


Mathematics lessons: students' views





Teacher-centred or student-centred?



Final question

Bearing in mind the changes you have experienced over the last 5 years and the professional development you have received:

- What needs to change now?

References

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

or from

diane.dalby@nottingham.ac.uk