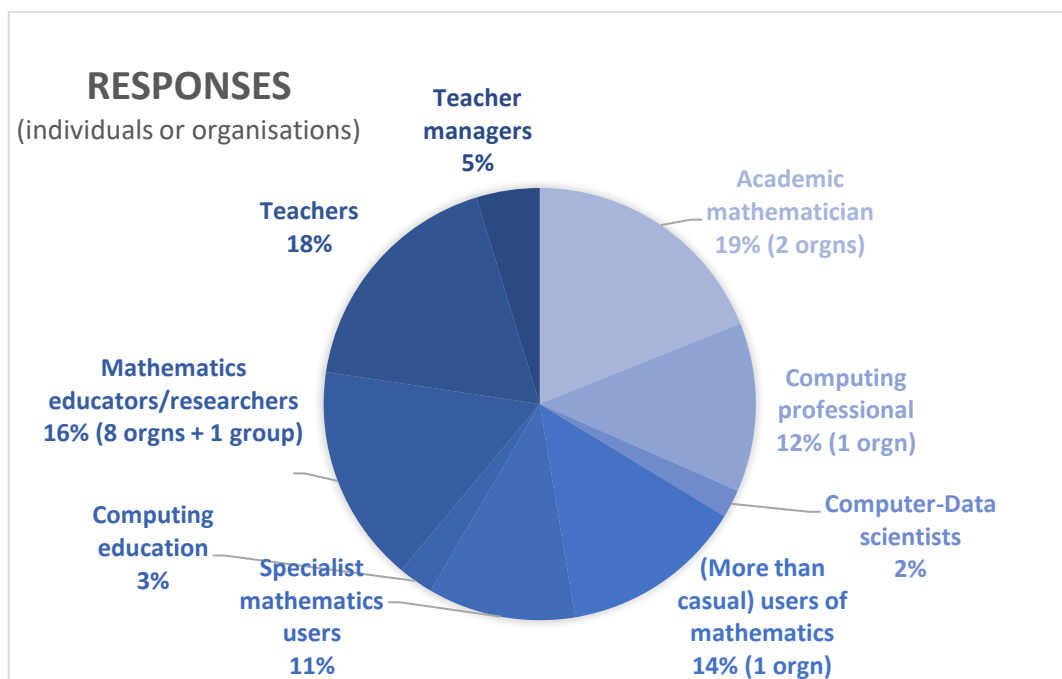


Royal Society ACME Mathematical Futures Board (MFB) Call for Views Analysis: Jennie Golding & Teresa Smart, UCL IoE

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Methodology technical note

The online questionnaire resulted in 191 usable responses. These were systematically and organised into nine (inexact and porous) core categories of respondent, to highlight synergies in responses. This was an iterative process as the backgrounds of respondents became clearer via their responses. Data synthesised for this report were based on questionnaire responses as follows:



- Some of these categories cover a wide range of occupational demands and lenses, but any such analysis will inevitably involve compromises. Responses were variously from individuals, from groups of professionals, or from professional organisations, and where we quote, we distinguish between those.
- These data were supplemented by responses from Wolfram, the British Computing Society, from part of the English DfE, and from a wide group convened by Education Scotland, as well as transcriptions of interviews with an education policy charity and the BBC, and notes from a workshop with two key funders. The final report reflects input from the sum of those sources, as well as input from the webinars referred to below, and from the MFB following a meeting in mid-May 2021.
- The Mathematical Futures programme is targeted at the whole of the UK, but nearly all responses, even from UK-wide organisations, were focused on the English education system, and particularly on government power to change the curriculum and assessment model for England. There were two (group) responses from Scotland, but none identifiably from Wales. One Northern Irish participant contributed to a workshop.

- It is important to note that the sample achieved is opportunistic, and likely to be from those with a particular interest in the theme: awareness was promoted through a variety of mathematics-related professional and other organisations, but responses can in no way be interpreted as fully representative of specific parts of mathematics (education or user) communities, and the depths and breadths of responses varied considerably. Care should then be taken in generalising from the findings.
- Contrary to expectations, very few questionnaire, open or workshop responses addressed mathematical needs differentiated by the MFB's initial five citizen segments; instead, suggested categories of need, and so provision (across at least three wide levels) emerged in a grounded way from the data.
- Consequently, initial open analysis and coding was within the above (emergent and iteratively reviewed) categories of respondents, rather than 'citizen segment', with intra-category open analysis of data within research question, giving rise eventually to axially grouped (Miles & Huberman, 2015) grounded (Charmaz, 2014) within-, but often also across-respondent category themes. Emerging analysis was validated on a continuous basis within the research team, but also with Royal Society staff, and was then contextualised within the national and international mathematics education policy field, at a high level. Repeated visits to the original data during analysis and writing support some claim to data saturation; nevertheless, issues of reporting outlying responses remain a challenge in a data set of this size.
- Open responses were analysed in a similarly grounded way after those in the questionnaire. They were then incorporated into the emerging report by question area, as either adding specifics or breadth to particular pre-existing themes, or in some cases, giving a complementary response not significantly represented elsewhere.
- The main focus of the report is on exploring the qualitative views submitted by respondents. The number of people or organisations putting forward a view in an open consultation is not a valid metric for weighing up qualitative evidence. Our analysis takes into account the broad weight of argument (sometimes expressed tangentially, or in other contexts, in answers to other questions) and of the person or body offering any given view: their expertise, membership size, experience, and other factors need to be taken into account. Clearly views of large organisations representing multi-membership need to be given due weight, but this does not diminish the importance of individual responses. Individual responses are quoted where they provide a contrasting or illuminating comment.
- Given that for many questions, across-group responses had much in common, although sometimes in differential depths and with differential emphases, across-group responses were analysed to give rise to five grounded themes for questions 2 and 4-8 (it not proving possible to do so for questions 1 and 3). Some indication of degree of occurrence of each of these themes is given graphically in Appendix 2, but as explained above, that quantitative analysis offers very limited insight.
- Initial findings of this report were shared with invitees to three complementary workshops in late April 2021, comprising in turn a) mathematics academics, and computer science and data science specialists; b) specialist and non-specialist users and policy personnel; c) teachers, educators and education researchers. Substantive discussion was carried out via three focus groups in each webinar – nine focus groups in all. The purpose of these webinars was to validate emerging analysis, though they also enriched and, on occasion, challenged, that. A formative discussion was then held with the MF Board. The final report synthesises the range of views expressed via these different routes.

- Such a report inevitably presents a selective and subjective narrative: there is a wide range of valid contributions to make to the debate, but any overarching account of responses needs to make choices about the relative role given to, and the communication of, those views if the report is to best support the refinement of the Mathematical Futures Board’s thinking, and feed into subsequent stages of the project.
- Potentially ‘telling’ (Mitchell, 1984) quotations are highlighted in the report to both exemplify statements made and to support a rich account.
- Shaping of analysis into interpretative narrative was initially by respondent group and then, given large degrees of commonality of theme, leading to cross-group themes, synthesis and discussion. Selection of such narrative was initially by discussion within the research team. That is intrinsically subjective, drawing as it does on contributions already selected from contributors’ thinking, followed by interpretation of, and selection from, those by the team, and then choice-intensive shaping into a whole. Such choices depend in part on the weights given to different contributions. Individual experts commenting on own field of expertise and quoting well-respected evidence, group of professionals commenting on impacts only marginal to their field, sociologist with primary concerns around equity of opportunity, parent with a striking personal story of mathematical under-serving.... all have valid contributions to make to the debate, but any overarching account of responses needs to make choices about the relative weight and role given to, and the communication of, those views if the report is to best support the refinement of MFP’s thinking and next stages of the project. Discussion with RS ACME support staff around the emerging themes and the choices being made in relation to selection and presentation of views, was productive at this stage.
- Such analysis, interpretation and narrative was then contextualised within, and related to, a range of current and emergent national debates around the roles and purposes of the mathematical sciences and their applications, changing economic and societal needs, and related education and other policy issues, at a high level. Such contextualisation and linking is again subjective, so that validation of, and balance in that should assume a central role.

Steps taken to ensure trustworthiness of the analysis include:

Authenticity	<ul style="list-style-type: none"> • The research team both have an initial background in mathematics, followed by a professional career initially in school mathematics teaching, with later involvement in national (English and other) mathematics education policy, and teacher education in a variety of jurisdictions. They are now based at UCL Institute of Education. • The analysis/interpretation were critiqued at intervals within the team, by RS ACME staff, and by mathematics education colleagues in UCL IoE. These actions supported a deliberate cultivation of reflexivity in relation to approach and data. • Approach and findings are presented in detail, so open to scrutiny, in this document, and will have been shared, and critiqued, with the Mathematics Education Group at UCL IoE.
Credibility	<ul style="list-style-type: none"> • Approaches to analysis, selection and interpretation were co-constructed by the research team on an ongoing basis. Continued efforts were made to craft a narrative close to the data, so as to minimise researcher bias; nevertheless, any such account remains to some extent subjective. • Cross-researcher triangulation of subset of emergent interpretations. • All data available for subsequent Royal Society use. • Proactive seeking out of a small number of participants where interpretation was problematic • Stakeholder workshops used to validate and refine the findings given, and to support engagement with the final report and subsequent stages of the project.
Transferability	<ul style="list-style-type: none"> • Limited, because of the nature of the sample, although ‘thick description’ is provided in the report, including in the use of quotations potentially ‘telling’ (Mitchell, 1986).

Dependability	<ul style="list-style-type: none"> • All questionnaire data coded, then at least 10% of all data re-coded independently by PI, and discrepancies resolved; • Cross-researcher triangulation of emergent interpretations of questionnaire, free-form and workshop responses and at multiple scales; similar approaches used at each stage of analysis, and in reverse between researchers during report writing. • Contact was maintained with Royal Society ACME staff and both open and subject to robust questioning from them, so as to contribute to validation and ensure alignment of emerging analysis/interpretation/reporting with requirements. • Significant use has been made of quotations in the report, to exemplify interpretations.
Confirmability	<ul style="list-style-type: none"> • Methodology, including interpretation, validated at a high level by researchers' institutional research group, and with interested others in a variety of conference fora. • The draft report was open to MFP Board scrutiny and questioning, including in relation to validity of interpretation, selection and narrative • Approaches and findings presented in detail, so as to be open to scrutiny • UCL 'Safe Data Haven' and Royal Society curation of anonymised (for individuals) data.