




Methodology

Formative evaluation: a summary

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What is the Cambridge Mathematics Framework and how is it evidence-based?

Summary

- The Cambridge Mathematics Framework is designed to act as a meaningful and useful aid to teaching and designing coherent mathematics learning experiences for students
- The Cambridge Mathematics team gathers data to evaluate our efforts to design the Framework and its contribution to the mathematics education community
- Signals and indicators from different audiences are the key to our methods of collecting formative evidence about the value of the Framework
- The internal review process enables us to check consistency in Research Summaries
- The external review process enables us to check the value of research underpinning the Framework
- Specific uses of the Framework are pilot-tested so that we can refine features before release

Why is evaluation of the Cambridge Mathematics Framework important?

The Cambridge Mathematics Framework should be meaningful, useful and used as an aid to teaching and designing coherent, connected mathematics learning experiences for students. As part of the design process, the team collects evidence and reports on ongoing evaluation efforts so that potential users can understand what has influenced the design of the Framework. The team also collects data to evaluate whether the way in which content is developed is likely to contribute to meaningful engagement with mathematical ideas among Framework users.

How is the Cambridge Mathematics Framework being evaluated?

Evaluation of the Framework and its content is ongoing and takes many forms. During initial development, preliminary **signals** and **indicators** of the value of the Framework are the key to our methods of gaining formative evidence. As different audiences have different areas of professional expertise, we have developed a formative evaluation strategy to align and test the trustworthiness of each part of the Framework using appropriate signals, audiences and indicators¹.

Audiences

Our audience includes individuals in several roles. In order for the Framework to represent knowledge that is accessible to many different people, we treat feedback from different individuals as an important piece of the picture in the development of the Framework. Our targeted audiences include:

- Internal reviewers – members of the Cambridge Mathematics design team.
- External reviewers – academic researchers and professionals with experience in teacher education and/or classroom teaching for evaluating sections of the Framework called **Research Summaries**.
- Collaborators – academic researchers in mathematics education, national-level curriculum developers and mathematicians with experience in educational design, teacher education, professional development and/or classroom teaching.
- Pilot test case partners – other teams conducting work that allows them to test specific uses of the Framework in an authentic context.
- Glossary survey participants – mathematics teachers, teacher educators and/or educational designers who provide some basic information about their professional experience.
- Pilot UX interview participants – teachers, teacher educators, educational designers, and academic researchers in mathematics education who may have more than one of these roles.

¹ Methodology: Formative Evaluation document, table 2

In addition, general audiences might encounter our project, website materials and/or social media posts. General audiences may include:

- Conference participants – professionals in mathematics education (academic researchers, teachers, teacher educators) who attend conferences.
- Website and newsletter readers – the audience that provides feedback through comments and viewer statistics, which indicate engagement.
- Social media followers – this audience is notified when the team posts new material on a specific platform such as Twitter

For more detail on our audiences, please check the [Methodology: Formative evaluation](#) document

Indicators and Signals

Our documents and activities should have the lowest barriers to engagement possible so that we can (a) reach a large number of people, and (b) obtain feedback from our audiences.

Indicators from our *targeted* audiences often include detailed feedback in response to questions we have developed, research we have conducted and feedback we have already received. Indicators from our *general* audiences may include information about the structure and content of the Framework and level of engagement, where a high level of engagement suggests that our project has relevance to mathematics education communities.

The following documents and activities are signals that audiences can engage with and offer feedback on:

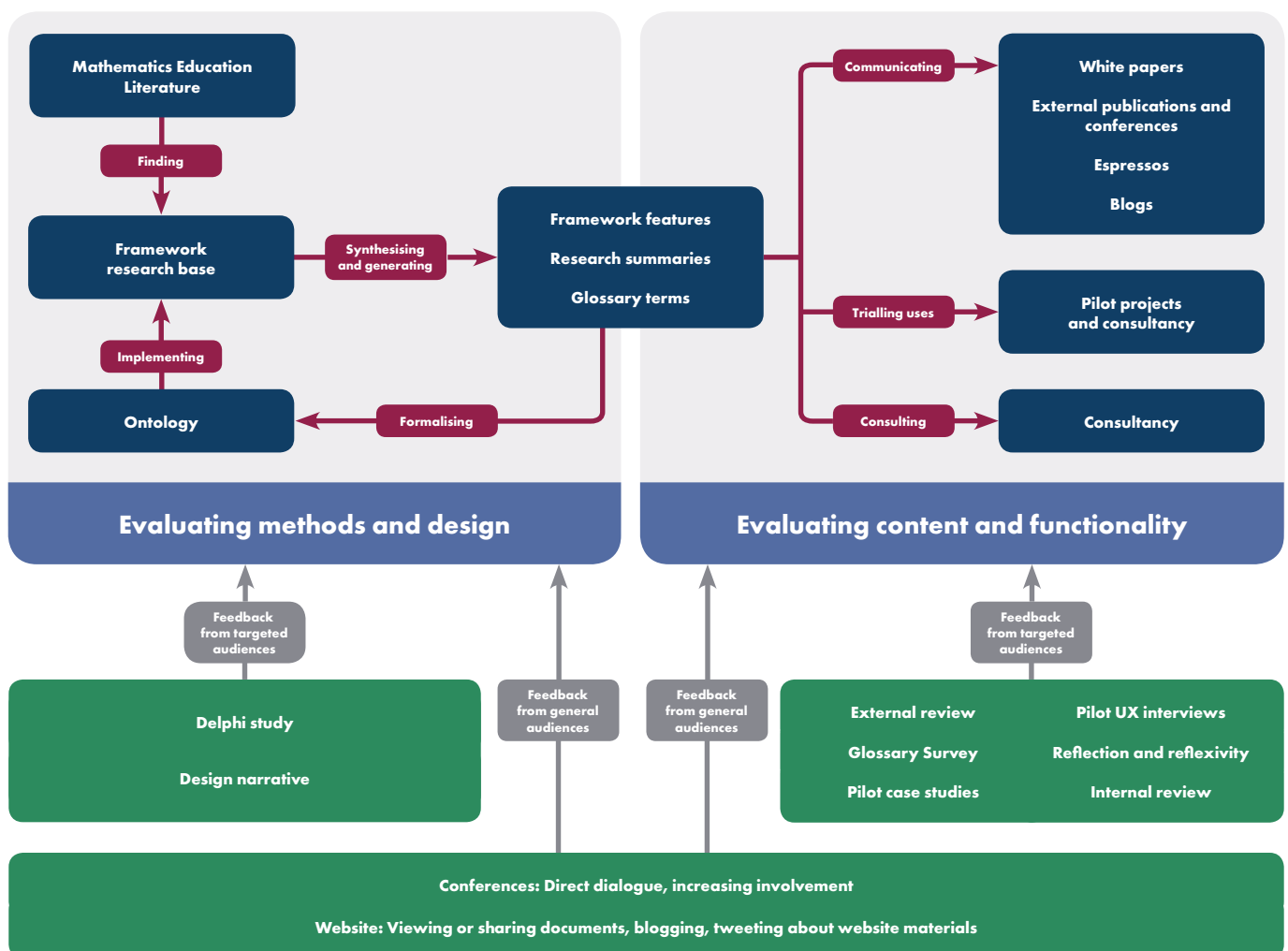
- Research Summaries – short internal papers written by the Cambridge Mathematics team that explain how research has informed sections of the Framework.
- Framework content – the names, descriptions and examples given in [waypoints](#), the names of themes and how waypoints are connected by themes.
- Internal reports – working summary documents that enable the team to keep track of Framework design, interpreting feedback and the overall narrative of design influences and changes made over time. These often form the basis of reports published on the website.
- Research white papers – include information on our perspectives, approaches, justifications and methods, and on the issues we have engaged with in our work.

- Peer-reviewed research papers – similar to white papers, but more focused on specific elements of our work.
- Published professional articles – appear in widely-read publications and focus on issues in mathematics education.
- Delphi round reports – provide a summary and analysis of opinions and points raised by the **Delphi panel** after each survey round.
- Published definitions of key mathematical terms – definitions that may later be offered in the Framework glossary.
- Conference presentations – conference discussions help us to connect with possible collaborators and raise the community's awareness of the Cambridge Mathematics project.
- Demonstrations of Framework design tools and content – offer audiences a first impression of our content, structure and design tools during meetings and conferences.
- Espressos – two-page summaries of research and its implications in different areas of mathematics education are published monthly for teachers and teacher educators.
- Blogs – weekly wide-ranging, informal and brief discussions of topics in mathematics education that the team is engaged with in some way.
- About Us – a page on our website which offers brief biographies of team members to enable our audiences to build a picture of our perspectives, backgrounds and qualifications.
- Events – a page on our website which shows to our audiences our involvement in events we have hosted, presented at or attended; also included are additional events we wish to highlight to them.

Formative evaluation methods – what evaluation methods do we engage in?

Figure 1 illustrates the types of formative evaluation we engage in, the feedback we receive as data and how each type of evaluation is integrated in our design process.

Figure 1: Evaluation in the Cambridge Mathematics Framework design process



External evaluation of methods and design: Delphi

Decisions regarding the research, design method, ontology or the structure of the design of the Framework are informed by research and the expertise and experiences of the team. We conducted a **Delphi study** to collect external feedback and navigate areas of uncertainty. The three rounds of semi-structured questionnaires enabled us to find areas of agreement and disagreement in the group of experts, which then informed our design.

Internal evaluation of methods and design: Design narrative

The team maintain internal notes from literature reviews and meetings to record major design decisions. Research sources are annotated and decisions regarding sets of waypoints in the Framework are explained in Research Summaries. This informs our internal work and communicates our methodology to wider audiences.

How do we evaluate content and use?

The team engages in **reflexivity** through sharing research processes and practice with each other. For more detail on reflexivity, please see **Methodology: Building the Research Base** document. An **internal review process** acts as a **reliability** exercise. Completed internal reviews of Research Summaries and accompanying content are sent out for **external review**, which is carried out by invited **external reviewers**. A semi-structured questionnaire is used to collect feedback from external reviewers regarding the Research Summary. Framework writers consider reviewers' responses when adjusting content in the Framework and the narratives in Research Summaries. For more detail on what the external review involves, please see **Methodology: Formative Evaluation** document.

Specific uses of the Framework are pilot-tested so that we can refine certain features before release. These include the use of the Framework in curriculum design, textbook authoring, assessment item design and mapping to a segment of a curriculum. *CM Define It* is a survey app for participants to provide feedback on definitions accompanying a given mathematical word; this will inform the Framework glossary. For more detail, please see the **Methodology: Glossary app** document.

The team meets regularly to discuss the implications of feedback and how to incorporate it. Reports of selected formative evaluation studies will be published on our website.