

A MANIFESTO FOR CAMBRIDGE MATHEMATICS

CAMBRIDGE $\sqrt{\text{Mathematics}}$

The mission of the University of Cambridge is to contribute to society through the pursuit of education, learning, and research at the highest international levels of excellence.

Cambridge Mathematics is a collaborative enterprise in pursuit of this mission. The four University partners¹ are committed to championing and securing a world class mathematics education for all students from 5 – 19 years old, applicable to both national and international contexts and based on evidence from research and practice. We will call on our institutional courage and use the leadership, authority and expertise of the University to develop a coherent, transparent, evidence-based vision for Cambridge Mathematics – a vision that will make a major contribution to mathematics education internationally.

A Manifesto for Cambridge Mathematics

We believe that the study of mathematics is worthwhile for its own sake and as a key form of intellectual development. It is critical for the understanding of many other subjects and essential for functioning within modern society. Our vision is that the model of mathematics education that we intend to devise will emphasise the richness and power of maths, will encourage continued study of the subject and will be recognised world-wide as innovative and rigorous in approach. It will take into account the different needs in a changing world and contribute to learners' personal, societal and economic well being. The enactment of the vision will draw on the expertise that resides in the University, and on that of our colleagues across the world.

The invitation

Although the University partnership will be responsible for the stewardship of the Framework and the development of Cambridge Mathematics, we invite the international mathematics and mathematics education communities to engage with us in public conversation and debate as the development progresses. This conversation began with the launch of the Cambridge Mathematics initiative in March 2015.

AIMS

Cambridge Mathematics is a long term programme of developments and by 2020 we aim to have made considerable progress towards the seven subsidiary aims:

- to champion and secure **access** to a quality maths education for all
- to **collaborate** to use our position in maths education, to show **leadership** and to develop an authoritative **voice**
- to develop a coherent Cambridge Mathematics **Framework** for all ages and types of learner with a strong distinctive approach, **led by academics and educationalists** and supported by a strong **research base**
- to develop and make available world class **teaching and learning materials**
- to support an infrastructure to enhance the quality of **teacher education and continuing professional development**
- to develop **assessments** that support the development of powerful mathematical reasoning
- to develop an approach that is **recognised and valued** by parents, young people, teachers, institutions and governments.

PRINCIPLES

The four principles underpinning our work are:

- access for all
- evidence based
- collaboration and consultation
- coherent and integrated programme.

Access for all

Cambridge Mathematics will champion access for all students.

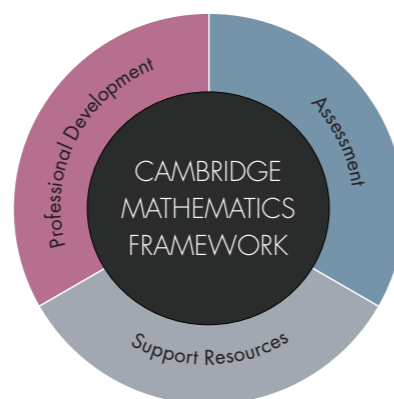
Evidence based

We will use rigorous research to determine the most effective ways of working that will improve outcomes.

Collaboration and consultation

We will work and consult with partners in mathematics education both nationally and internationally, and in the public and private sector.

Coherent and integrated



The four integrated elements of Cambridge Mathematics are:

- the Cambridge Mathematics Framework, the content spine to which the other elements will link
- resources, both paper based and electronic
- a coherent formative and summative assessment offer
- a professional development framework encompassing both subject and pedagogical knowledge.

ELEMENTS

The Framework

The Framework will:

- be a map of the full domain of mathematical knowledge from pre-school to the end of the upper secondary phase of education and training arrangements
- be loosely age-related and based on progressions in organising concepts and principles
- be the basis for different curriculum pathways which will flesh out a more detailed hierarchy
- be a basis for deriving standards
- be illustrated by indicative content and exemplar performances
- be evidenced both from the study of a range of mathematics curricula and mathematics assessments, and from a theoretical perspective of conceptual progression
- allow for the description of skills and dispositions necessary for effective use of mathematics

Resources

The supporting resources and professional development offer will link to the framework and exemplify identified effective pedagogies. Paper based and electronic resources will be designed according to theoretical perspectives offered by expert groups such as ISDDE² and in line with the best practice we can find in a domestic and international analysis of learning approaches and their accompanying resources. We will make use of technology where it is appropriate. We envisage a range of resources to support a range of programmes of study arising from different curriculum pathways.

Assessment

Whilst we know that high quality resources are an important factor in curriculum coherence,³ in practice we also know that in the vast majority of classrooms worldwide, high stakes assessments hugely influence the implementation of the intended curriculum. They can either be a barrier or a lever for change.⁴ Ensuring further high quality assessments is therefore of vital importance. Existing assessments will be mapped against the framework. New assessments will be designed to promote well thought-out routes leading to well defined end points, with clear opportunities for progression for all students at every level.

Professional development

Teacher education has a sizeable impact on student outcomes.⁵ Based on evidence from recent national and international surveys,^{6&7} we intend to design a coherent professional development offer that enables teachers in contrasting international contexts:

- to be well-versed in mathematics subject knowledge
- to have a deep understanding of how mathematical learning happens and possess a rich repertoire of teaching strategies
- to use technology
- to develop and share their experiences.⁸

The Framework will be in the public domain. Programmes of study, assessments, resources and professional development that can be closely mapped to the Framework may be badged with 'Cambridge Mathematics' so that, world-wide, educators will know that they are part of an evidence based, coherent and integrated offer with the highest aspirations.

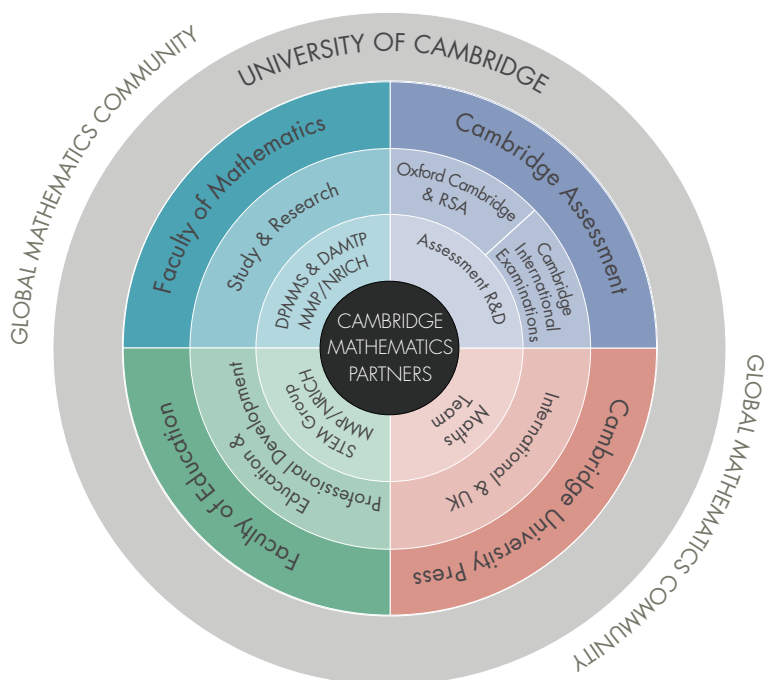
THE RATIONALE FOR CAMBRIDGE MATHS

The impetus for action lies in the national, and international, appetite to address:

- the growing awareness that existing national mathematics curricula do not always meet the personal, societal and economic needs of all learners
- the realisation that, to secure economic prosperity of a nation the opportunities for creative problem solving need to increase
- the need to do more than produce ‘well educated deferential citizens’, but a public able to engage critically and constructively with numerate argument

and, more specifically, to address:

- low levels of adult numeracy. In many countries low numeracy is an especially strong predictor for long term deprivation and the life chances for adults who operate below primary level mathematics are poor⁹
- the disparity in uptake of maths post-16 across the world
- the international problem in teacher recruitment and retention
- performance in international comparisons of mathematical competence (eg TIMMS and PISA).



Notes

- 1 Cambridge University Press, Faculty of Education, Faculty of Mathematics and Cambridge Assessment
- 2 International Society for Design and Development in Education www.isdde.org
- 3 Oates (2010) *Could do Better: Using international comparisons to refine the National Curriculum in England* Cambridge Assessment
- 4 Burkhardt et al (1990) The dynamics of curriculum change in *Developments in school mathematics education around the world Vol2* NCTM
- 5 Coe et al (2014) *What makes great teaching?* Sutton Trust
- 6 NCETM (2009) *Researching Effective CPD in Mathematics Education*
- 7 Walter & Briggs (2012) *What professional development makes the most difference to teachers?* University of Oxford
- 8 Schleicher (2012) (Ed) *Preparing Teachers and Developing School Leaders for the 21st Century* OECD
- 9 Parsons & Bynner (2005) *Does Numeracy Matter?* National Research for Adult Literacy and Numeracy