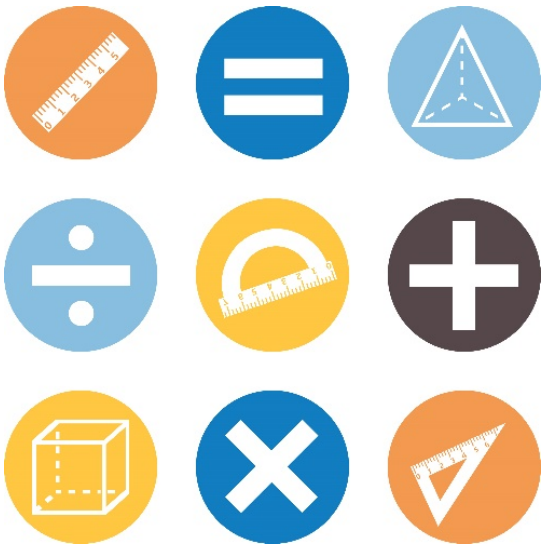
Cambridge Assessment International Education

Teacher Guide

with advice for Cambridge Primary Mathematics 0096

This Cambridge Teacher Guide is for use with the Cambridge Primary Mathematics Curriculum Framework published in September 2020 for first teaching in September 2021.



Version 1.0

Cambridge Pathway

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Contents

Introduction

Welcome to the Cambridge Primary Mathematics Teacher Guide. This guide is designed to provide a suggested approach to the implementation of Cambridge Primary Mathematics in your school.

It includes:

- an introduction to Cambridge Primary Mathematics, including an overview of the design and content of the curriculum framework and schemes of work
- step-by-step guidance on the planning process
- guidance on effective teaching for Cambridge Primary Mathematics
- guidance on creating a positive learning environment
- guidance on monitoring learners' progress and evaluating evidence to inform next steps for teaching and learning
- information about assessments provided by Cambridge International
- information about training and other support available from Cambridge International
- a glossary of the key terminology used in this guide.

If your school already delivers one or more Cambridge Primary subjects, you may already be familiar with some of the information covered in this teacher guide. However, we still recommend that you familiarise yourself with this guide, especially *Section 1: Overview of Cambridge Primary Mathematics*.

The structure of this teacher guide allows you to find, use and refer back to sections when they are relevant to you. Where sections contain information that is relevant to many subjects, you will often find Mathematics-specific exemplification too. This will enable you to see easily how the information relates to Cambridge Primary Mathematics.

Subject-specific exemplification is indicated by a coloured vertical line to the left of the text.

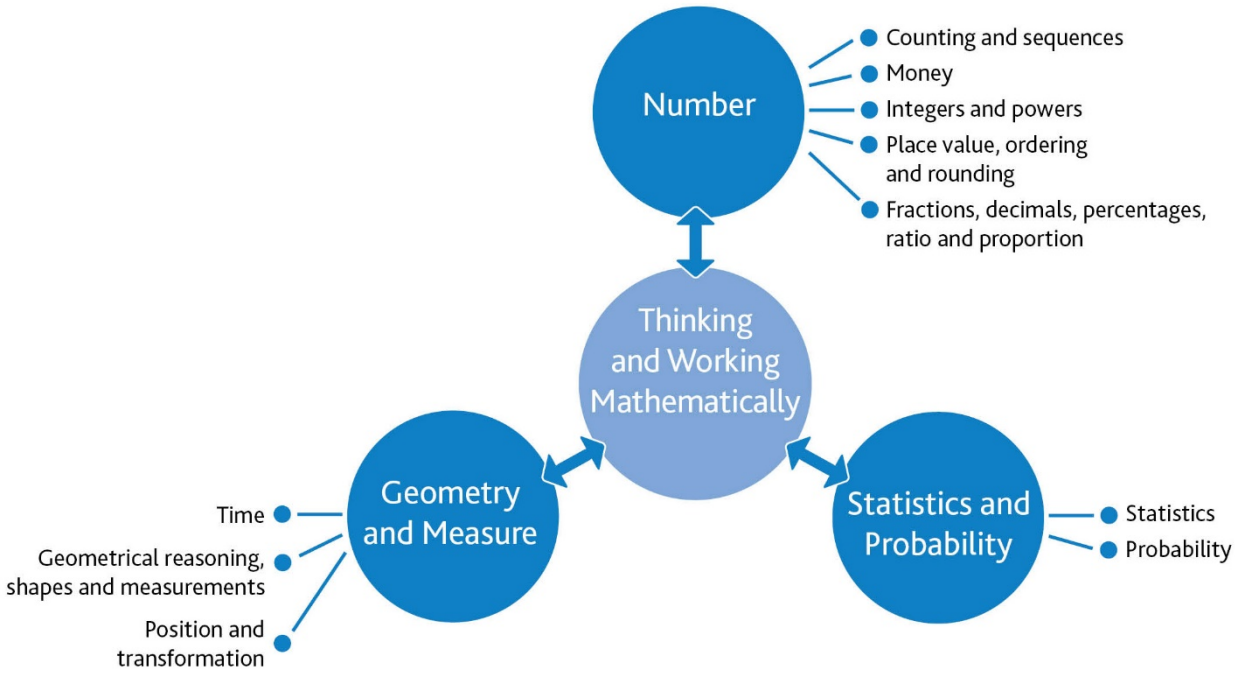
This teacher guide should be read alongside the Cambridge Primary Mathematics Curriculum Framework and the accompanying schemes of work at **https://primary.cambridgeinternational.org** Here you will also find additional resources to support your school's implementation of Cambridge Primary Mathematics (see Section 6.1).

Section 1: Overview of Cambridge Primary Mathematics

1.1 The curriculum framework

The Cambridge Primary Mathematics Curriculum Framework provides a comprehensive set of learning objectives for six stages. The curriculum framework is typically for learners aged 5 to 11, but it may be appropriate to use it for slightly different ages to suit your context.

The learning objectives in the curriculum framework provide a structure for teaching and learning. They also provide a reference for checking learners' development of knowledge, understanding and skills. The learning objectives are divided into main areas of learning called 'strands': Number; Geometry and Measure; and Statistics and Probability. Although each strand is presented separately, it is intimately connected to the other strands. Thinking and Working Mathematically is embedded in all three strands of the curriculum. It is not an independent strand. Thinking and working mathematically helps learners look at things in a mathematical way so that they can better understand mathematical problems and find solutions to them. (See Section 3.4.)



Each strand is divided into 'sub-strands', which are listed in the diagram above. Here is a brief description of each strand:

Number
Learners first learn about numbers and their properties through counting objects. They learn that numbers represent quantities. They identify patterns and sequences of objects and numbers, which helps them with their early algebraic thinking.

As learners develop number sense and recognise number relationships, they understand the importance of place value, fractions and the calculation process. Learners develop confidence in calculating by learning to estimate first, calculate mentally and use written strategies before they check their solutions with a calculator. They explore the laws of arithmetic and order of operations, and how these assist in simplifying calculations.

From Stage 4, learners begin to learn about percentages, equivalence and negative numbers. In Stage 5, they are introduced to decimal numbers, order of operations, ratio and proportion.

Geometry and Measure
Learners investigate geometrical relations in two and three dimensions. They use mathematical language to describe geometrical properties of shapes. They identify horizontal, vertical and diagonal lines of symmetry as well as reflective and rotational symmetry.

Learners explore position and directions to describe and interpret movement in terms of cardinal and ordinal points. They also explore the relative position of coordinates. From Stage 5, they use their knowledge of 2D shapes and coordinates to plot points to form lines and translate shapes.

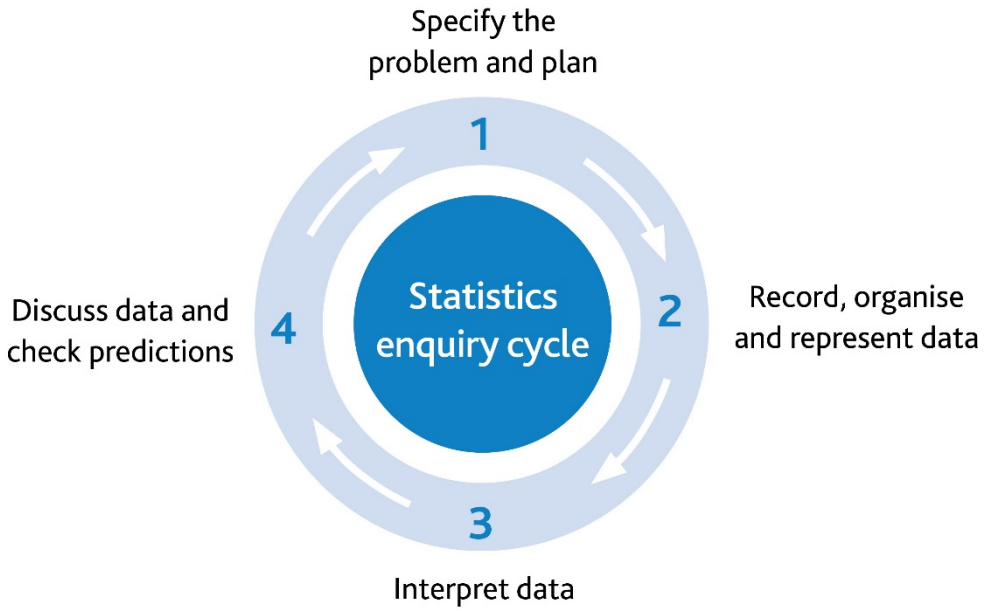
When learners explore measure, they develop an understanding of different systems of measurement (length, mass, capacity, temperature and time). They use their skills of estimation before physically measuring and calculating answers to mathematical questions. Learners investigate the relationships between length, area and perimeter by first exploring 2D shapes and then compound shapes.

Through this strand, learners should understand the difference between drawing and sketching. When learners *draw* lines and shapes, they should use equipment such as rulers and set squares to ensure that the properties are accurate. When learners *sketch* lines and shapes, they understand that their sketches are representative only and may not be precise.

Statistics and Probability
Learners plan and conduct investigations within and between data sets. They identify similarities and variations within and between these data sets to answer statistical and non-statistical questions. They discuss their conclusions and consider the sources of variation.

This strand emphasises statistical thinking so that learners can understand and explain what we use data for, and how data within and between datasets varies and why. Learners learn to interpret data presented in charts, tables, diagrams and graphs. This is a useful skill that will help them understand information in the real world, which is often presented graphically.

Learners conduct simple statistics investigations as part of a four-part statistical enquiry cycle:



When learners explore probability, they use language associated with patterns, randomness, chance, likelihood and probability. They recognise the difference between probabilities that are modelled through experiments using a small and large number of trials. They conduct chance experiments, using small and large numbers of trials to recognise the difference between experimental and theoretical outcomes. They present and describe the results using the language of probability.

1.2 Key features of the curriculum framework

Note: Some key terminology relating to Cambridge Primary Mathematics is included in the glossary at the back of this teacher guide. There is also a glossary in the Cambridge Primary Mathematics Curriculum Framework.

Mathematical fluency, reasoning, and thinking and working mathematically underpin the Cambridge Primary Mathematics Curriculum Framework. You should integrate the principles and strategies of thinking and working mathematically in all your mathematics lessons (see Section 3.4). The process of thinking and working mathematically encourages learners to talk with others, challenge ideas and provide evidence that validates conjectures and solutions. When learners are thinking and working mathematically, they actively seek to make sense of ideas and build connections between different mathematical facts, procedures and concepts.

1.3 Progression in learning

The curriculum framework is a planning tool. The learning objectives within it are designed to promote progression in learning from Stage 1 to Stage 6 and onwards into Lower Secondary. It enables development of knowledge, understanding and skills through a spiral approach: by revisiting and engaging with topics and skills at deeper levels and in different contexts across the stages.

The tables below contain some example learning objectives. They show how the development of knowledge, understanding and skills progresses across the six primary stages.

	Number learning objectives
Stage 1	**1Nc.06** Use familiar language to describe sequences of objects.
Stage 2	**2Nc.06** Recognise, describe and extend numerical sequences (from 0 to 100).
Stage 3	**3Nc.05** Recognise and extend linear sequences, and describe the term-to-term rule.
Stage 4	**4Nc.04** Recognise and extend linear and non-linear sequences, and describe the term-to-term rule.
Stage 5	**5Nc.03** Use the relationship between repeated addition of a constant and multiplication to find any term of a linear sequence.
Stage 6	**6Nc.03** Use the relationship between repeated addition of a constant and multiplication to find and use a position-to-term rule.

	Geometry and Measure learning objectives
Stage 1	**1Gg.03** Identify, describe and sort 3D shapes by their properties, including reference to the number of faces, edges and whether faces are flat or curved.
Stage 2	**2Gg.05** Identify, describe, sort and name 3D shapes by their properties, including reference to number and shapes of faces, edges and vertices.
Stage 3	**3Gg.05** Identify, describe, sort, name and sketch 3D shapes by their properties.
Stage 4	**4Gg.05** Identify 2D faces of 3D shapes, and describe their properties.
Stage 5	**5Gg.04** Identify, describe and sketch 3D shapes in different orientations.
Stage 6	**6Gg.04** Identify, describe and sketch compound 3D shapes.

To enable effective progression in your teaching of Cambridge Primary Mathematics, you need to be familiar with the progression of knowledge, understanding and skills across stages. This will help you

to build on prior learning in every stage. The progression of learning objectives across Stages 1 to 6 is available at **https://primary.cambridgeinternational.org**

The ideas in the schemes of work provide guidance on the types of teaching and learning activities appropriate at each stage (see Section 1.4).

1.4 The schemes of work

This teacher guide provides support in using the Cambridge Primary Mathematics Curriculum Framework to plan and deliver lessons using effective teaching and learning approaches. To support your planning there is also a scheme of work for each stage at **https://primary.cambridgeinternational.org**

The scheme of work for each stage of Cambridge Primary Mathematics contains:

- suggested units showing how the learning objectives in the curriculum framework can be grouped and ordered
- at least one suggested teaching activity for each learning objective
- a list of subject-specific language that will be useful for your learners
- common misconceptions
- sample lesson plans
- links to relevant NRICH activities from **https://nrich.maths.org/** to enrich learners' mathematical experiences.

You do not need to use the ideas in the schemes of work. Instead, use them as a starting point for your planning and adapt them to suit the requirements of your school and the needs of your learners. The schemes of work are designed to indicate the types of activities you might use, and the intended depth and breadth of each learning objective. These activities are not designed to fill all of the teaching time for a stage. You should use other activities with a similar level of difficulty, for example, those from endorsed resources.

Section 2: Planning

2.1 Getting started

This section looks at the process of planning how to develop your learners' knowledge, understanding and skills within and across the stages of the curriculum framework.

Planning is important to ensure:

- consistency across different groups of learners and different teachers
- availability of resources before starting to deliver lessons
- development of appropriate knowledge, understanding and skills according to your learners' needs
- a variety of teaching approaches to meet your learners' needs
- opportunities for monitoring, evaluation and feedback
- a positive and inclusive learning environment.

You need to plan:

- the knowledge, understanding and skills your learners need to develop in each term/semester
- the order, progression and continuity of knowledge, understanding and skills
- effective lessons led by learning objectives.

The following sections provide guidance on the planning process, including how you can build in flexibility to allow you to adapt coverage, delivery and timing to suit your teaching style and your learners' needs.

If you are delivering Cambridge Primary Mathematics for the first time, you can use the schemes of work as a starting point for your own planning. These are available at **https://primary.cambridgeinternational.org**

2.2 Description of planning stages

There are three main planning stages:

- **Long-term planning** involves outline planning of how to cover the curriculum framework for a particular stage across the school year. It includes thinking about:
  - timing of learning, including considering holidays, school events and educational visits, and outside activities that need to happen at suitable times of the year
  - access to resources, including considering whether resources are available or need to be purchased
  - balanced coverage of each strand in the curriculum framework
  - any concepts and skills that your learners might need more time to develop.

  Long-term planning involves making decisions as a school and in the context of your school's overall curriculum plan.

- **Medium-term planning** involves more detailed planning of the teaching sequence of learning objectives in each term/semester. It is also useful to record any initial ideas for effective teaching activities.

  Do not expect your medium-term plan to be perfect first time. Start with an estimate of how long you think learners will need to develop the knowledge, understanding and skills for the term/semester. Then adjust your plan as the term/semester progresses in response to the needs of your learners. You are the best judge of the capabilities of your learners and how long it will take them to develop the required learning.

- **Short-term planning** involves writing lesson plans. Lesson plans are led by the learning objectives, or parts of learning objectives, you are focusing on in the lesson.

  A lesson plan:
  - provides essential information for all adults involved in the teaching
  - improves continuity in the absence of regular teaching staff
  - considers the learning needs of all learners to create an inclusive learning environment
  - provides outlines of resources, timings, and teaching and learning activities.

  A key purpose of short-term planning is to build on learners' responses to previous lessons, enabling them to progress in their learning.

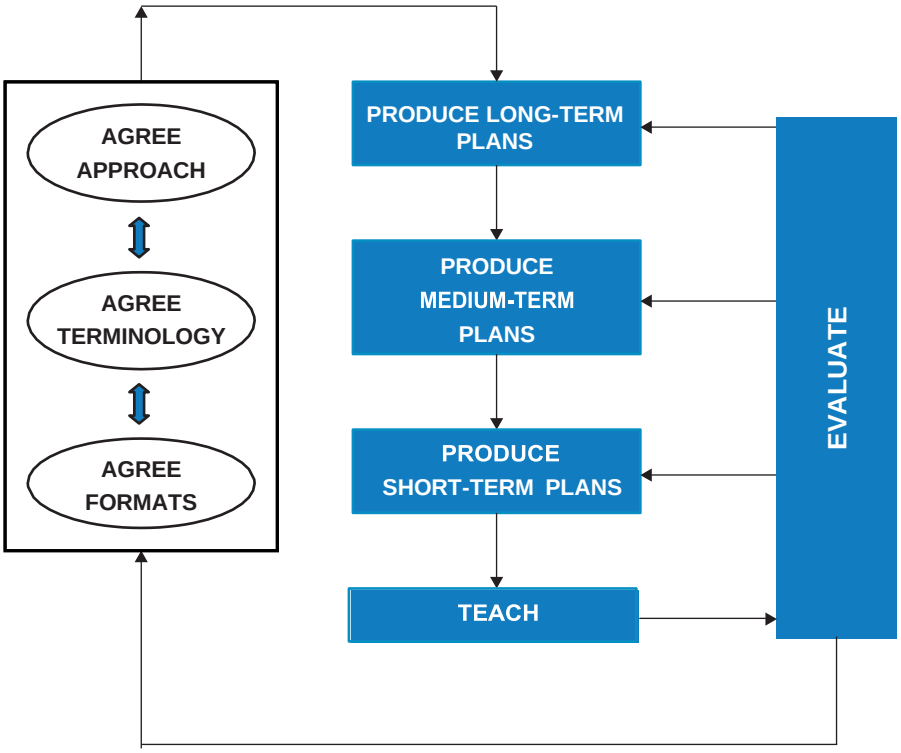
2.3 A consistent approach to planning

We suggest that you work with colleagues at your school to develop a consistent approach to planning. This will ensure the best possible support for learners' progression from Stage 1 to Stage 6. Discussions with your colleagues can also deepen your own understanding and inform your approaches to teaching. Discussions will build a network of teachers who understand the Cambridge Primary Mathematics Curriculum Framework and are able to deliver it in an effective and motivating way.

Finding shared planning time is not always easy. You may already have face-to-face planning time with your colleagues or you may need to decide how to organise this. You may also decide to collaborate with colleagues across the year using technology such as email, a virtual learning environment or social media (with appropriate privacy settings).

Before starting to plan, you and your colleagues will need to download the Cambridge Primary Mathematics Curriculum Framework from **https://primary.cambridgeinternational.org** and familiarise yourself with its structure and coverage.

The diagram below provides a suggested approach to collaborative planning:



It is likely that you will decide to have separate planning time for producing long-term, medium-term and short-term plans (the middle column of the diagram). However, it is also useful to have an initial meeting for all the teachers who will deliver Cambridge Primary Mathematics to discuss and make the decisions shown in the first column of the diagram:

- **Agree approach:** Decide with colleagues and management the general approach to delivering Cambridge Primary Mathematics. This includes how frequently the subject will be delivered, for how long and by which teachers.

- **Agree terminology:** Ensure everyone involved in teaching Cambridge Primary Mathematics understands the key terminology relating to planning and the curriculum framework so that, for example, 'long-term plan' means the same to everyone.

- **Agree formats:** Although it is not essential for everyone to use the same documentation for recording planning, it is very helpful for communication and common understanding of curriculum requirements. We recommend that all teachers delivering Cambridge Primary Mathematics use the same templates.
  Possible templates are available at **https://primary.cambridgeinternational.org**.

Evaluating planning

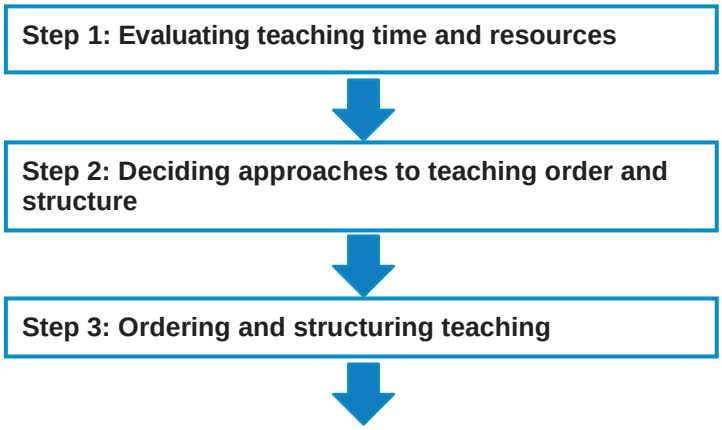
It is always a good idea to check how well something works before moving forwards. Therefore, the 'Evaluate' stage in the diagram above is a very important stage. The arrows in the diagram show how evaluation of teaching informs all the stages of planning. If there is a problem delivering a lesson (for example, if learners need more time than expected to develop a skill), it is often assumed that there is something wrong with the lesson plan. This can be true, but sometimes the problem is because the medium-term plan or long-term plan needs changing in some way. Your initial decisions (in the first column of the diagram) may also need to be revisited.

You should expect to adapt how you teach Cambridge Primary Mathematics as you find out what works well with your learners.

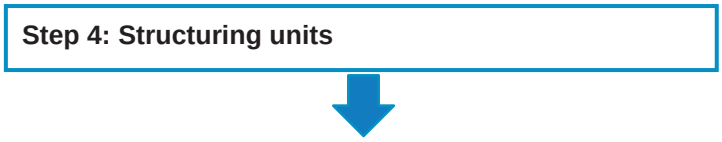
2.4 The planning process

The process for planning each stage of the Cambridge Primary Mathematics Curriculum Framework can be divided into three phases. These phases are shown in the diagram below. The steps in each phase are explained in detail in Sections 2.5–2.7.

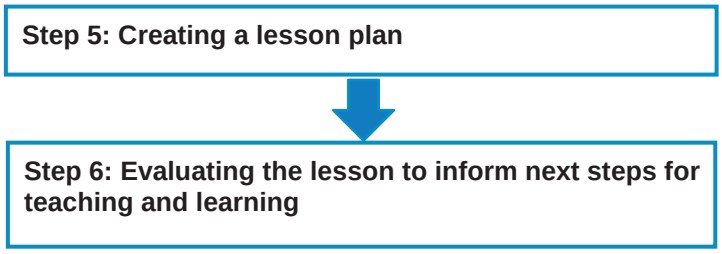
Phase 1: Long-term planning



Phase 2: Medium-term planning



Phase 3: Short-term planning



You can use the schemes of work for Cambridge Primary Mathematics at **https://primary.cambridgeinternational.org** to support your planning.

2.5 Long-term planning

Step 1: Evaluating teaching time and resources

Establish the amount of lesson time available for Cambridge Primary Mathematics and how this is split across the year.

Here are some questions to consider:

- How many lessons are there for Cambridge Primary Mathematics in each term/semester?
- How many teaching hours are there in each term/semester?
- How many teaching hours are there across the year?

Remember to consider the impact on teaching time of any school events or educational visits.

For guidance, the Cambridge Primary Mathematics Curriculum Framework is based on learners having 4 to 5 hours of Mathematics per week (or about 120 to 150 hours per stage). Your actual number of teaching hours may vary according to your context.

Create a list of key resources for Cambridge Primary Mathematics, and consider which resources are available in your school and which resources you need to purchase.

Step 2: Deciding approaches to teaching order and structure

Decide the overall approach you want to take to the teaching order and structure of Cambridge Primary Mathematics.

Here are some questions to consider:

- Will we need to share teaching and learning resources? If so, how will we do this?
- Do we have any preferences about which content is covered in each term/semester? Do we need to plan to have outside activities or educational visits at a suitable time of year?
- Will our learners find some areas of learning more difficult? Do we need to allow extra time for teaching these? When in the year would it be better to teach these more difficult areas?
- Are there any concepts or skills that our learners will need more time to develop?

Step 3: Ordering and structuring teaching

Consider how you will order teaching across the year and how you will structure it into units.

Here are some questions to consider:

- Which content and skills will we cover in each term/semester?
- How will we group content and skills within each term/semester?
- Which content and/or skills is it beneficial to teach together?
- Which learning objectives is it beneficial to revisit more than once across the year?
- How will we ensure that we have included each learning objective for the stage?
- Do our units form a logical whole with meaningful learning and progression?

As part of your long-term planning for Cambridge Primary Mathematics, consider these questions too:

- How will you ensure that there is a balance of Number, Geometry and Measure, and Statistics and Probability across each term/semester?
- How will you ensure that the teaching order of the mathematics content is productive? Learners may need to be aware of some knowledge and skills in the Number strand before they are able to access learning in Geometry and Measure, or Statistics and Probability.
- Have you already got a wide-ranging bank of activities to encourage thinking and working mathematically?
- How can you make connections between mathematics and real-life everyday problems?
- It is important to have consistency across the stages of learning. So how will you plan for this with the teachers in the stage before and the stage after your stage?

The schemes of work for Cambridge Primary Mathematics at **https://primary.cambridgeinternational.org** provide suggested units in a possible teaching order.

2.6 Medium-term planning

Step 4: Structuring units

Record your learning objectives for each unit with ideas and guidance on teaching approaches and activities.

Here are some questions to consider:

- What prior experience do we expect our learners to have?
- What new knowledge, understanding and skills do we need to teach? How long will learners need for this learning?
- Is there a natural order of teaching for the learning objectives within each unit?
- Which learning objectives should we revisit across units? Which parts of these repeated learning objectives will be the focus for each unit?
- What teaching approaches will we use?
- What activities can we use to teach the learning objectives?
- What is the key vocabulary for each unit?
- What are the key resources for each unit?

See Section 4.2 for more information about resources and Section 4.3 for more information about digital technologies and eSafety.

As part of your medium-term planning for Cambridge Primary Mathematics, consider these questions too:

- How will you integrate thinking and working mathematically with the mathematical content?
- How will you give learners a wide range of activities to encourage thinking and working mathematically?
- How will you ensure that learners have opportunities to connect mathematics to real-life everyday problems?
- What possible misconceptions will you need to consider in each unit?
- Do all your learners speak English as their first language? Or will you need to provide additional support to some of them (e.g. to promote confidence in using technical mathematics language)?
- How will you ensure that there is a balance of Number, Geometry and Measure, and Statistics and Probability in each unit?
- What opportunities will you give learners to apply knowledge, understanding and skills in a range of different contexts?
- How will you make links between objectives in different strands? For example, what opportunities will you give learners to explore concepts in the Number strand before they apply these in Geometry and Measure?
- What opportunities will there be for more extended mathematical problems that continue across a number of lessons?

The schemes of work for Cambridge Primary Mathematics at **https://primary.cambridgeinternational.org** provide one possible medium-term plan. They arrange the learning objectives in units in a logical and progressive teaching order. Each learning objective has at least one suggested teaching and learning activity. Activities are designed so that learners are actively engaged in their own learning. More information about teaching approaches can be found in Section 4 of this teacher guide.

2.7 Short-term planning

Step 5: Creating a lesson plan

Producing detailed lesson plans for single lessons is particularly useful when first working with the Cambridge Primary Mathematics Curriculum Framework. Remember that lesson plans should be led by the learning objectives (or parts of learning objectives) that are the focus for the lesson.

Good lesson planning enables successful teaching and an enjoyable learning experience. However, lesson plans should be flexible enough to be adapted. New learning builds on learners' prior knowledge, understanding and skills. Before teaching new content or skills, it is important to check that learners have the required prior experience. If the required prior knowledge, understanding and skills are not secure, you will need to address this before introducing new content and skills. Sometimes learners might be ready to move on more quickly than you anticipated. Sometimes they might need more time and support on a particular concept or activity.

We recommend you consider the following when creating lesson plans:

- learning objectives (or parts of learning objectives) and concepts/skills you will focus on
- success criteria (see Section 5.2)
- planned activities
- how activities will consider the needs of all learners
- resources
- timing for each part of the lesson
- groupings (individuals, pairs, small groups, whole class) and group sizes
- expectations for learner outputs
- opportunities for identifying misconceptions
- opportunities for evaluating achievement of learning objectives to inform next steps for teaching and learning. (See Section 5 of this teacher guide for more information about monitoring and evaluating learners.)

As part of your short-term planning for Cambridge Primary Mathematics, consider these questions too:

- How will you identify learners' difficulties and mathematical misconceptions?
- When will you give learners the time to explain their own strategies for finding answers to problems?
- Where will you find opportunities for learners to use their first, second or third language to discuss technical mathematics language?
- When can you include links to relevant NRICH activities to enrich learners' mathematics experiences, from **https://nrich.maths.org/?**
- How will you decide on one or two success criteria for each lesson, even though your lessons may contribute to several learning objectives?

The schemes of work for Cambridge Primary Mathematics at **https://primary.cambridgeinternational.org** contain sample lesson plans to guide your own lesson planning.

Step 6: Evaluating the lesson to inform next steps for teaching and learning

You must be prepared to amend your lesson plans for subsequent lessons to reflect the learning that has already taken place. A good set of lesson plans may have notes written all over them to show what went well, what should be considered for the next lesson and what might be changed before using the same lesson with another class.

Here are some questions to consider after a lesson, to inform your future lesson plans:

- How did my lesson plan help me to respond to my learners' needs? What changes did I make from my plan and why?
- What did each learner achieve today? What progress did they make?
- Are we ready to move on, or do I need to revisit aspects of the learning objectives with all or some learners?
- Is there anything I need to remember when teaching this lesson to another class?

Planning helps you to ensure that all necessary learning is achieved across a term/semester or year. Although 'unplanned' activities should not lead your teaching, you should not stick so firmly to your intended lesson plans that you cannot follow a new idea. Excellent lessons can result when something happens to stop a planned lesson, for example, a local or national event or when an individual brings something interesting into school. Learning takes place when learners are motivated and enthusiastic.

So, you should feel able to use such stimuli to develop learners' knowledge, understanding and skills in line with the curriculum framework.

Sometimes you may find that learners achieve learning objectives more quickly than you expected. This will allow flexibility to plan additional activities that encourage broader or deeper learning.

Section 3: Teaching and learning approaches

This section considers some of the different teaching and learning approaches that Cambridge International recommends for developing learners' knowledge, understanding and skills in Cambridge Primary Mathematics.

3.1 Active learning

Active learning involves learners being engaged in their learning rather than passively listening and copying information. Learners take part in a variety of activities that involve thinking hard. The focus should always be on the learning objective, rather than the task itself.

Active learning can take place inside the classroom or outside the classroom, and by working individually, in pairs, in small groups or as a whole class. It can be done with or without the use of special resources and digital technologies. It may involve moving, but it does not need to. The important thing is that learners are engaged in their own learning and have some responsibility for their progress.

Active learning encourages learners to think about their thinking (metacognition) through opportunities to plan, monitor, evaluate and make changes to progress their learning.

Useful principles for active learning include:

- identifying and building on learners' prior experiences
- ensuring that activities have an appropriate level of challenge: neither too easy, nor so challenging that they can't succeed even with guidance
- using a variety of individual, pair, group and whole-class activities
- promoting effective communication (see Section 3.3)
- using success criteria to give learners some responsibility for their own progress (see Section 5.2).

Your role in active learning is to direct and scaffold learning, and to prompt links with prior learning. You can also encourage regular self- and peer-assessment (see Section 5.6).

For Cambridge Primary Mathematics, you can promote active learning in the following ways:

- Ask learners to explore simplifying calculations in different ways using the laws of arithmetic (e.g. different strategies to find 8 x 15, such as 15 x 2 x 2 x 2 or 8 x 30 ÷ 2).
- Give them opportunities to investigate geometrical relations in two and three dimensions, using mathematical language to describe the geometrical properties of shapes.
- Teach learners to plan and conduct mathematical investigations so that they can understand and explain what we use data for, and how data within and between datasets varies and why.

You can find more information about active learning in the Cambridge International resource *Getting started with Active Learning* at **https://www.cambridge-community.org.uk/professional-development/gswal/index.html**

3.2 Learner groupings

There are many different ways of grouping learners. As you plan your lessons, aim to use an effective balance of individual, pair, group and whole-class activities to develop both independence and collaboration:

Individual activities
Learners benefit from working independently at times. One way of helping learners to become more independent is to use the 'three before me' rule: learners are expected to use three different sources of information (for example, talk partner, different peer, resources) before they ask you. Peer- or self-assessment can be beneficial following individual activities (see Section 5.6).

For Cambridge Primary Mathematics, you could try these individual activities:

- Learners think about all the possible solutions to a mathematics problem. For example, *How many possible answers can you find by combining 3, 4 and 5 with + and × ?*
- Learners look at a mathematics problem that gets progressively more challenging. For example, ask them to sketch quadrilaterals (square, rectangle, rhombus, parallelogram, trapezium and kite). Then ask them to label each shape with information about angles and symmetry.
- Learners carry out independent research. For example, ask them to compare two children's books in order to decide which is easier to read. They should compare the word length, number of images, number of pages and words per page of the two books.

Pair activities

Having someone to share ideas with is invaluable. A critical friend can offer advice and new ideas. Working in pairs helps learners to build meaning while both partners are focused and engaged in their own learning.

For Cambridge Primary Mathematics, you could try these pair activities:

- Display a calculation, such as $3 + 1 + 2 \times 6 + 4 \times 2 = 44$. Learners discuss in pairs whether they think the answer is correct or incorrect.
- Give each pair a set of 0–9 digit cards. Learners take turns to make a 4-, 5- or 6-digit number with 3 decimal places (for example, 27.819). They tell their partner the value of each digit and see if they agree.
- Learners take turns to sketch a 3D shape (for examples, a cube or a square-based pyramid). Can their partner name the shape?
- Give learners a simple map on a grid of squares. Learners take turns to give instructions for a route between two features on the map. Their partner has to follow the route.

Group activities

When working in small groups, learners can support and guide each other's learning, and learn how to collaborate and cooperate.

For Cambridge Primary Mathematics, you could try these group activities:

- Allocate groups of learners a different graph or chart. Each group researches the advantages and disadvantages of a graph or chart and prepares a poster to present to the class.
- Small groups of learners move round a circus/carousel of activities, trying out each one.
- Learners work in small groups. They discuss activities they could measure in different units of time: hours, minutes, seconds, days, weeks, months and years.

Whole-class activities

Consider the purpose of whole-class activities carefully to ensure that all learners are engaged.

For Cambridge Primary Mathematics, you could try these whole-class activities:

- Ask the class to count aloud. For example, *Count up in 4s, starting from 7: 7, 11, 15, 19, 23 …*
- Play a class game of 'Guess My Number'. Learners ask yes/no answer questions to gradually deduce your number. For example, *Is your number even? Is it greater than 100? Is it a multiple of 3?*
- Display a list of division questions. Include a variety of questions, so that for some of them it would be more efficient to solve them mentally, and for others it would be more efficient to solve them using a formal written method. Ask learners to demonstrate different strategies in front of the class. Then invite other learners to feed back on the efficiency of each strategy.

Organising learner groupings

Learners can be grouped in many ways. Allowing learners to choose their own groups often results in friendship groups, but learners need experience of working with a variety of peers. So, it can be useful to organise groups yourself.

One quick method of grouping learners more randomly is to have numbered groups and to allocate a group number to each learner, for example as they enter the room. If learners are choosing their own

groups, give them instructions for how to choose sensible 'working' groups and a time limit to arrange themselves (say 30 seconds).

How you group learners for a particular activity might depend on your method of differentiation (see Section 4.1).

Assigning group roles

One way to support group activities is to assign a role to each group member. This allows each learner to focus on one particular area whilst still working towards a shared goal. It is important that group members still communicate with one another so everyone inputs into the group's progress towards their shared goal.

The group roles you choose will vary according to the activity. Key responsibilities that the roles might include are:

- making sure everyone has the resources they need
- making sure everyone has the information they need
- making sure everyone is involved in tasks, discussions and decisions
- keeping a record of ideas and decisions
- making sure the task is completed on time
- reporting findings, for example, by presenting to the whole class.

Once learners are proficient in different group roles, you might allow learners to decide amongst themselves who will take on each role.

Guidance on monitoring group activities is included in Section 5.4.

Setting rules for group activities

Learners need clear rules about how to conduct group activities. You should discuss and develop these with your class. They could include some of the following:

- Respect and value everyone's opinions.
- Do not interrupt when others are speaking.
- Encourage everyone to speak.
- Give and accept constructive criticism.
- Take your fair share of the tasks.
- Support each other and make sure everyone understands.
- Stick to deadlines.
- Listen to each other and to any teacher instructions.

To encourage more effective collaboration, it is important that learners talk with each other rather than asking you to provide answers or to make decisions for them. You might want to introduce a rule which limits the number of questions each group can ask you during any one lesson or learning activity.

You need a clear signal to indicate when you want the class to stop and listen. One way of doing this is by positioning yourself at the front of the room and holding up your hand. Another effective method is counting down from five to zero with the expectation that by the time you reach zero the class is silent and still, and all eyes are on you.

3.3 Developing effective communication

Language awareness

Language awareness means understanding the possible challenges and opportunities that language presents to learning.

Language is an essential communication tool in all lessons, and you should celebrate learners' diversity of languages. Even though the Cambridge Primary Mathematics resources are written in English, it does not mean that all the communication in your lessons must be in English.

Learners need a minimum level of linguistic and conceptual knowledge in their first language to develop a second language successfully. Once this knowledge is firmly established in a first language, learners can draw on this learning when working in an additional language.

Learners will benefit from being able to use their first language to aid their understanding of Cambridge Primary Mathematics. By communicating in different languages, they will be able to transfer skills, concepts and learning strategies across languages. To do this, it is important that all Cambridge Primary Mathematics teachers are 'language aware'. This means understanding the possible difficulties that language presents to learning. Such difficulties might arise because a learner is learning your subject through an additional language, or it might be the first time a learner has come across certain vocabulary or structures in their first language.

A teacher who is language aware understands why learners face the difficulties they do and what they can do to support them. You can encourage them to make use of their first language to understand ideas and concepts. You can pre-teach key vocabulary and use visuals with words to encourage understanding. Pre-teaching key vocabulary can also help to promote a more inclusive learning environment. This does not mean giving learners a list of random words to go away and look up in a dictionary. This will only demotivate them. Instead, you can introduce vocabulary to learners by using photos or familiar contexts of interest to learners. You can ask learners to create mind maps, or brainstorm known words and phrases to help them access a text, audio or video clip.

The schemes of work for Cambridge Primary Mathematics at **https://primary.cambridgeinternational.org** contain lists of key vocabulary that it would be useful for your learners to know. You can use these lists to guide your vocabulary pre-teaching. You should also aim to model using key vocabulary in your lessons.

Promoting talk

Using talk partners helps to create a positive learning environment. Many learners feel more confident discussing with a partner before giving an answer to the whole class, and learners get opportunities to work with different people.

Using talk partners:

- involves all learners
- enables learners to practise speaking skills in a safe environment
- helps learners to generate ideas and opinions in a safe environment
- develops coherent thinking
- enables learners to learn from each other
- enables participation by learners who are less confident in whole-class situations
- develops collaborative and cooperative skills
- provides thinking time
- encourages extended responses.

You can organise talk partners in a structured or a random way. It can be beneficial to change partners at regular intervals.

For example, for Cambridge Primary Mathematics, you could ask learners to solve a calculation and then discuss their strategy with a talk partner.

One effective technique is 'think, pair and share'. Learners are given the opportunity to think about a question, then discuss it with a talk partner and then share their ideas with a small group or the whole class.

For example, for Cambridge Primary Mathematics, you could ask learners to explore all the possible whole-number areas of rectangles with a perimeter of 16 cm.

- First, learners think individually about how many different areas they can identify.
- Next, they share their answers with a talk partner and agree on the total number of areas they have identified.

- Finally, learners present their answers to the whole class. Ask them to explain why they are sure that they have found all the possible whole-number areas. Discuss their results.

Managing discussions

Group or whole-class discussions enable learners to develop their own thinking and learn from one another. Discussion also gives learners the opportunity to practise their language and communication skills. Effective topics for discussion build on prior knowledge and enable learners to generate a range of different ideas and opinions.

Every class has a mix of louder and quieter learners. This poses two challenges: how to encourage quieter learners to participate in discussions and how to stop more confident learners taking over discussions. Here are two strategies for encouraging participation from all learners:

- **Speaking tokens:** Give each learner four tokens (these could be buttons, pebbles or small pieces of paper). Each time a learner contributes to a discussion, they put down one token. Their aim is to put down all their tokens by the end of the discussion. This encourages quieter learners to offer their ideas. Louder learners have to prioritise their comments, which gives others more chance to participate.

- **Discussion prompts:** To encourage learners to talk about different ideas, you can use a range of discussion prompts.
  For example, in Cambridge Primary Mathematics you could start a discussion about equivalent fractions, decimals or percentages. Then use the following questions to prompt more discussion:
  - *$\frac{2}{5}$ of 40 and $\frac{8}{10}$ of 20 are both 16, so $\frac{2}{5}$ and $\frac{8}{10}$ are equivalent fractions. Do you agree?* (No) *Explain why.*
  - *Eva thinks that $\frac{1}{4}$ is the same as 0.4, which is the same as 4%. Who agrees with Eva? Who doesn't agree with her? Why?*

3.4 Approaches to teaching and learning in Cambridge Primary Mathematics

Sections 3.1–3.3 above provide guidance on active learning, using different group sizes for activities and effective communication. These are all important for Cambridge Primary Mathematics. This section gives you guidance on other teaching and learning approaches that are very important for Cambridge Primary Mathematics.

We have designed Cambridge Primary Mathematics around the principle of thinking and working mathematically so that the content is meaningful for learners and leads them to have a rich understanding of mathematics.

All six primary stages use a three-step teaching approach – concrete, representational, abstract (CRA): first, learners use objects to support them in understanding a new concept. Next, they transform the concrete model to a pictorial representation of the same concept. Finally, they learn how the pictorial representation relates to conventional mathematical symbols and notations.

For example, try this when you introduce the concept of addition:
First, use counters to show that two counters and one counter total three counters all together (concrete stage).
Next, draw circles to represent the counters. Discover that two circles and one circle total three circles all together (representational stage).
- Finally, show how the circles represent the symbols 2 + 1 = 3 (abstract stage).

For some concepts, this three-step approach may take several weeks or months to complete.

Thinking and Working Mathematically

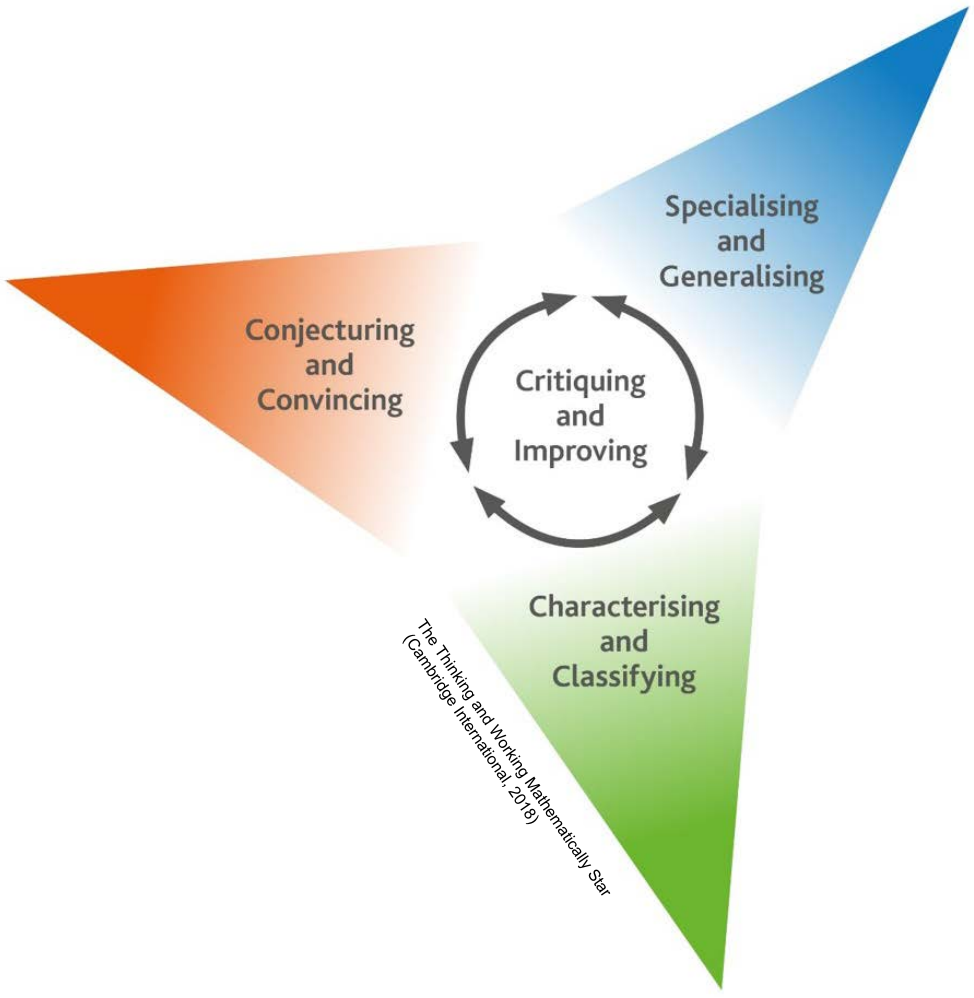
Thinking and Working Mathematically supports the mathematical concepts and skills in all strands of the Cambridge Primary Mathematics curriculum. When learners think and work mathematically, they actively engage with their learning of mathematics. They try to make sense of ideas and build connections between different facts, procedures and concepts. Learners who do not think and work mathematically can carry out processes that their teacher has shown them, but they may not understand why the processes work or what the results mean. Noticing inconsistencies, patterns and particular representations encourages learners to think and work mathematically. Practice, reflection and questioning will help them to improve.

Thinking and Working Mathematically has eight characteristics that are presented in four pairs:

- Specialising and Generalising
- Conjecturing and Convincing
- Characterising and Classifying
- Critiquing and Improving.

The Thinking and Working Mathematically Star shows these four pairs:

The eight Thinking and Working Mathematically characteristics are all closely connected and interdependent.



The Thinking and Working Mathematically Star (Cambridge International, 2018)

A high-quality mathematics task may include one or more of them. The characteristics provide learners with the language they need to think and work mathematically. Learners can then decide what mathematical knowledge, procedures and strategies to use in order to gain a deeper understanding of mathematical questions.

The table below shows the eight thinking and working mathematically characteristics and their definitions. It also gives examples of how you could introduce the characteristics into your lessons. There are more examples in the scheme of work for each stage of learning.

TWM Characteristic	Definition
TWM1 Specialising	Choosing *an example* and checking if it satisfies or does not satisfy specific mathematical criteria
Example **2Gg.12** Understand a measuring scale as a continuous number line where intermediate points have value. Ask learners to find and measure as accurately as they can an object in the classroom that is longer than 5 cm but shorter than 10 cm. Ask learners: *How many such objects can you find in 2 minutes?* Learners will show that they are **specialising (TWM1)** when they find objects that meet this criteria.	
TWM 2 Generalising	Recognising an underlying pattern by identifying *many* examples that satisfy the same mathematical criteria
Example **3Gt.02** Read and record time accurately in digital notation (12-hour) and on analogue clocks. **3Gt.04** Understand the difference between a time and a time interval. Find time intervals between the same units of time in days, weeks, months and years. Tell learners that an animal needs to be given medicine every 50 minutes throughout the day. This is the time interval between each dose of medicine. Then tell learners that the first dose is at 8:00 am. Show them the first five times of the day when the animal needs to be given medicine: 8:00 am, 8:50 am, 9:40 am, 10:30 am, 11:20 am Read the times aloud, with the class joining in. Ask learners: *Do you notice a pattern in the times? Can you use this pattern to work out when to give the animal the next dose of medicine?* Learners will show that they are **generalising (TWM2)** when they notice a pattern in the times of day and use this to work out the next time when the animal needs to be given medicine.	

TWM Characteristic	Definition
TWM3 Conjecturing	Forming mathematical questions or ideas
TWM4 Convincing	Presenting evidence to *justify or challenge* a mathematical idea or solution

Example

5Gg.05 Identify and sketch different nets for a cube.

Ask learners to draw a sketch of a net for a cube. Then ask them to compare their net with another learner's net.

Ask learners: *Are your nets the same or different?*

Encourage learners to discuss what they have found as a class. Choose different pairs of learners to explain what they noticed when they compared nets. Learners should realise that there is more than one way to draw a correct net for a cube. Show learners some nets of cubes that you made before the class. Demonstrate how they fold into cubes.

Then ask learners how many different possible nets there are for a cube. After they have written their answer, they investigate to see if their answer is correct.

Ask learners: *How can you be sure you have found all the possible nets?*

Learners will show that they are **conjecturing (TWM3)** when they form ideas about how many nets of a cube can be drawn and give reasons for their ideas. They will show that they are **convincing (TWM4)** when they sketch their nets and show that they can be folded to form cubes.

TWM5 Characterising	Identifying and describing the mathematical properties of an object

Example

6Gg.01 Identify, describe, classify and sketch quadrilaterals, including reference to angles, symmetrical properties, parallel sides and diagonals.

For this activity, learners work in pairs.

Give each learner a piece of paper and ask them to fold it in half. Ask them to draw any quadrilateral on one half of the paper, using a ruler and pencil. Ask them to write a list of properties on the other half of the paper. They should write as many properties as they can to describe their quadrilateral.

Now ask learners to tear their pieces of paper in half. They should hide their drawing and give the list of properties to their partner. Learners then try to draw their partner's quadrilateral, using only the list of properties as their instructions.

When they have finished, ask each pair of learners to work together to compare the new drawings with the original drawings. They should discuss whether the list of properties is accurate, and why the drawings are (or are not) the same.

Learners will show that they are **characterising (TWM5)** when they identify several properties, such as parallel sides, symmetry, diagonal and angle properties, to describe various quadrilaterals.

TWM Characteristic	Definition
TWM6 Classifying	Organising objects into groups according to their mathematical properties

Example

3Sp.01 Use familiar language associated with chance to describe events, including 'it will happen', 'it will not happen', 'it might happen'.

Ask learners to think of events which definitely will happen, events which definitely will not happen, and events which might happen. Ask them to think of at least two examples for each event and to write each one on a separate piece of paper.

Learners will show they are **specialising (TWM1)** when they identify examples of events to satisfy each of the criteria.

Then ask learners to swap their pieces of paper with another learner. Ask them to organise their partner's events into definitely will happen, definitely will not happen or might happen. Ask learners to discuss if they have sorted the events correctly.

Learners will show they are **classifying (TWM6)** when they sort the events correctly.

TWM7 Critiquing	Comparing and evaluating mathematical ideas, representations or solutions to identify advantages and disadvantages
TWM8 Improving	Refining mathematical ideas or representations to develop a more elegant approach or solution

Example

4Ss.01 Plan and conduct an investigation to answer statistical questions, considering what data to collect (categorical and discrete data).

For this activity, learners work in pairs.

Tell learners that new a new café is going to open near your school. What would the café owner want to know? Learners design a questionnaire to find out this information.

Learners write questions for the questionnaire. For example: *What food and drink do people want to buy? How much do people want to pay for their food and drink? What time should the café open? When should it close?*

Now ask learners to swap their questionnaires with another pair. They answer each other's questions. While they are doing this, they should also make notes on the questionnaire about any problems they find.

When they have finished answering the questions, they give the questionnaires back. Each pair reads the comments that the other pair has written. Then they refine their questions to make their questionnaire more effective.

Learners will show that they are **critiquing (TWM7)** when they evaluate the other pair's questionnaire and explain any problems with it. They will show that they are **improving (TWM8)** when they act on the advice of the other pair to refine their questions and develop a more effective questionnaire.

Cross-curricular links

It is important that learners can think critically and creatively as mathematicians. Therefore, we recommend that Cambridge Primary Mathematics is taught as a separate subject. This will help to build a solid foundation of the distinct knowledge, understanding and skills for Mathematics which enables learners to develop deep understanding.

Learners should have opportunities to apply their knowledge, understanding and skills in as many contexts as possible. This includes applying learning from one subject in:

- another subject
- experiences outside the formal curriculum (in co-curricular activities such as sports events, drama productions, concerts, charity activities)
- cross-curricular projects.

Making links between Cambridge Primary Mathematics and Cambridge Primary Global Perspectives will be particularly helpful in developing key skills in research, analysis, evaluation, reflection, collaboration and communication.

Helping learners to make these connections empowers them with the ability and confidence to think more holistically.

Here are some examples of activities that apply knowledge, understanding and skills from Cambridge Primary Mathematics in the context of other subjects:

- **Science:** Learners use data handling skills to choose how to present findings from a scientific investigation.
- **Art & Design:** Learners first investigate the features of 2D designs (e.g. shapes, sequences, symmetry). Then they use their findings as a prompt for their own artistic design. They should use effective measuring strategies when creating 3D designs.

Cross-curricular projects give learners an opportunity to use knowledge, understanding and skills from more than one subject. For example, as part of a project to make a school vegetable patch, learners use their science skills in order to discover the best conditions for healthy plants (temperature, light, water). To do this, they plan and conduct scientific investigations to compare the growth rate of different plants under different conditions. Then they use their mathematics skills to find the most useful statistical representation to show and interpret the data. Finally, learners present their findings. They could make a poster which summarises what they have discovered about growing vegetables. Alternatively, they could write a ‘Beginners’ guide to growing vegetables’ with a list of instructions.

To help you to identify other cross-curricular links and to make best use of the knowledge, understanding and skills taught in other subjects, it can be helpful for teachers across your school to plan collaboratively. Remember to ensure that cross-curricular activities always focus on learning objectives for one or more subjects in order to progress learning effectively.

Section 4: The learning environment

4.1 An inclusive learning environment

An inclusive learning environment gives all learners the opportunity to fulfil their potential.

Learners bring different competencies to their lessons. For example, some might excel in Mathematics and science, but find subjects where they need to write at length a challenge. Your learners will inevitably have differing language levels, and for some learners English might be a second, third or even fourth language. This diverse range of competencies and backgrounds should be celebrated.

As a teacher, it is part of your role to discover the competencies and backgrounds of your learners and to get the best from every learner. Achieving this will involve creating a positive learning environment in which all learners feel confident to make suggestions, take risks, ask for help and admit when they find something difficult.

By using a variety of teaching strategies, you can address the needs of learners with a variety of backgrounds, competencies and interests. These strategies will contribute to an overall inclusive learning environment. Each learner will feel valued and supported, and be able to develop and succeed in your lessons and beyond.

Benefits of an inclusive learning environment include:

- being able to connect with and engage all your learners
- being prepared to tailor prompts, support or challenge to individual needs
- being prepared to help learners with any issues that arise
- more motivating lessons for learners
- more confident learners who share their opinions and ideas, and ask questions
- more application and development of language skills
- happy and successful learners
- enthusiastic lifelong learners.

Teaching strategies for inclusive learning

To help motivate all learners, aim to present information in different ways for different activities, using a range of textual, oral, visual and hands-on resources. Wherever possible, use real-life contexts that are meaningful to your learners, and vary contexts to appeal to different learners.

Your focus should be on learning development rather than on presentation of learning. So, try to provide flexibility and choice in how learners demonstrate their knowledge, understanding and skills. You could let learners choose how to present their ideas to the class, for example, giving a verbal presentation, using a verbal explanation of an image, or using an on-screen presentation.

You can further develop an inclusive environment by:

- ensuring that all learners are familiar and comfortable with routines and expectations
- involving all learners in activities and discussions, for example, by randomly choosing learners to answer questions
- ensuring that all learners take an active role in their own learning process, for example, by using success criteria (see Section 5.2)
- giving learners opportunities to make their own decisions
- showing appreciation of everyone's ideas and contributions
- sharing or displaying strategies for effective collaboration
- encouraging learners to develop their own ideas, take risks and work creatively, for example, by modelling, sharing your thinking and learning from your mistakes
- ensuring learners have time to explore and consider ideas fully, for example, by giving adequate thinking time after asking a question
- encouraging learners to give reasons for their ideas, for example, by asking follow-up questions

- using varied questioning techniques and encouraging learners to ask their own questions (see Sections 3.3 and 5.3).

Feedback from learners can help you to develop an inclusive learning environment. A possible approach is to give out small pieces of paper at the end of a lesson. Learners record:

- how much they think they learned during the lesson using numbers 1 to 5, with 5 being the most learning
- how confident they felt during the lesson, using 

Learners could also record one or two suggestions for how you could help them to learn more. In the next lesson, you can explain and discuss the changes you are making so everyone feels included, and able to learn and achieve in the lesson.

In Cambridge Primary Mathematics, learners can engage with a topic through a variety of resources, including practical manipulatives. For example, they could fold paper to make 2D or 3D shapes or use manipulatives such as dice, dominoes or number cards. Make manipulatives available for learners to use during *any* mathematical activity, not just the activities where you ask learners to use them. You could also provide learners with a number of optional 'clues'. These will support learners who need more assistance in answering a particular question. Leave the clues in a common area of the classroom so that learners can decide whether they want to use them or not. If they can decide for themselves, they will feel in control of their learning.

Differentiation

Differentiation can help to make your lessons more inclusive. Differentiation means thinking about your learners' needs and trying to match teaching methods, learning activities, resources and the learning environment to individual learners or groups of learners. It aims to enable learners to reach their own goals through carefully planned activities, creating a positive learning experience and promoting successful learning.

Differentiation allows you to provide appropriate challenge for each learner. This can be by providing support for learners who are struggling with a concept or skill, and providing extra challenge for learners who achieve competence in a concept or skill more quickly.

For an inclusive learning environment it is important that support or challenge activities are based on the same learning objective as the rest of the class.

Some possible methods of differentiation are:

- **Using different learner groupings:** You can vary learner groupings depending on the learning activity or learning objective. For example, sometimes you might organise learners into groups containing learners with different competencies. By organising groups in this way, learners who need more support can gain ideas and skills from others, while other learners can develop their own understanding by explaining their ideas to others. In this way, all learners will be able to progress.

- **Varying the activity or outcome:** This is when learners work on the same learning objective in different ways. For example, different learners might use resources that offer different amounts of support, or different learners might demonstrate their learning in different ways.

- **Varying the amount of adult support:** This is when learners receive additional support from either you or a teaching assistant. For example, you might work with a small group of learners who need more support; other learners might work in unsupported groups with a summary sheet of questions to focus their learning.

4.2 Learning resources

For Cambridge Primary Mathematics, you only need basic mathematics resources (e.g. paper, pencils, rulers and calculators) for most activities. However, some schemes of work suggest the use of particular resources. If you have not got these resources, you can use your own resources instead. For example, if you do not have sets of 3D shapes, you can use appropriately shaped food packaging.

Calculators are useful teaching aids. Although learners need to practise doing mental and written calculations, calculators can help them to notice patterns. They are also useful when learners are solving problems where non-calculator calculation would take the focus away from strategies.

When used well, calculators can help learners to learn about numbers and the number system. Use calculators as a teaching aid to promote mental calculation and mental strategies and to explore mathematical patterns. Learners should understand when it is best to use calculators to help them calculate, and when to calculate mentally or using written methods.

As Cambridge International includes calculator-based assessments at Stages 5, 6, 7, 8 and 9, we recommend that learners begin to use calculators for performing and checking calculations from Stage 4. At Stages 5 and 6, learners should be developing effective use of calculators so that they are familiar with the buttons and functions of a basic calculator in readiness for Stage 7 onwards.

4.3 Digital technologies

Digital technologies are a valuable resource that can help learners to develop their knowledge, understanding and skills. They are particularly beneficial when used as one of a range of effective teaching and learning methods. To make best use of digital technologies in lessons, develop your awareness of a range of digital technologies and consider carefully how and why they can support learning. Your aim in using digital technology should be impact and progress, rather than to 'engage' and 'enthuse'.

Digital technologies can empower learners to be more autonomous in their learning. It is important that you and your learners are confident in evaluating when digital technologies may add value to the learning. Learners need to be critical in their selection of the most appropriate technology to support their requirements.

The technology you have available will influence how you choose to use it. For example:

- if you only have one computer available, you could set it up in an area suitable for independent activities such as research
- if you have audio/visual recording equipment available, you could use it to record learners as a basis for self- or peer-assessment activities
- if you have access to an interactive whiteboard or projector, you could use whole-class activities where learners present their work to others for evaluation and discussion
- if you have access to video conferencing tools, you could use them for collaborative activities with others beyond your school
- if you have access to a computer suite, you could use this for a particular investigation or research activity.

Mobile devices such as tablets can also be useful tools to support learning. They enable learners to make choices about when to use technology for a particular activity, such as making notes, researching and checking ideas, or preparing an interactive quiz.

There are many opportunities for using digital technologies in Cambridge Primary Mathematics. Here are two examples:

- When learners conduct chance experiments, they could use chance generators that model real-world situations. For example, they could use an online tool that flips a virtual coin 100 times. This will help learners to understand the difference between experimental and theoretical outcomes.

- Learners use online maps of their local area to discuss directions and distances.

Remember though that you should not overuse technology. It should only be used when there is clear added value for your learners.

You can find more information about digital technologies in the Cambridge International resource *Digital technologies in the classroom* at **http://www.cambridgeinternational.org/images/271191-digital-technologies-in-the-classroom.pdf**

Cambridge Primary Digital Literacy develops learners' understanding of how to use digital tools effectively and safely. You should be aware of the teaching and learning in Cambridge Primary Digital Literacy, and aim to provide opportunities for applying digital literacy skills through Cambridge Primary Mathematics whenever appropriate.

eSafety

There are many positives to using digital technologies, but you also need to make learners aware of the potential dangers and how to keep safe when using computers, especially online. You should provide opportunities for learners to consider their own behaviour when using digital technologies and the impact their actions can have on others.

We recommend that all schools have an acceptable use policy which describes in detail what learners and school employees should and should not do once they are given access to the school's computer network. Care should be taken to ensure that the acceptable use policy is followed in all lessons, including Cambridge Primary Mathematics lessons. If concerns arise, teachers should follow the policy, including making contact with local child protection and law enforcement agencies if appropriate. Ultimately it is your responsibility to make sure that learners are safe in your classroom and that they follow any national, regional or school regulations.

If internet sites will be used, you must check these before the lesson and make sure that all learners know how to use online resources safely and responsibly. Internet filtering and monitoring tools should always be in place and anti-virus software should be up to date.

Your guidance to learners will depend on their age, maturity, background and the content that is being delivered. Many online tools are designed for use by learners aged over 13, but younger learners can access this technology safely through supervised use or by using school-approved accounts. Learners should have clear instructions about what they should do if they feel unsafe when using digital technologies; this should include how they report their concerns.

4.4 Learning beyond school

Learning does not only occur in the school environment. To help broaden learners' understanding, it is important to consider learners' outside interests and experiences, and provide opportunities for them to make connections between experiences inside and outside of school. One way to enable this is to introduce new areas of learning by asking learners to share what they already know.

There are opportunities for you to broaden learners' understanding of Cambridge Primary Mathematics beyond school. Try these activities, for example:

- Plan a school trip together. Ask learners to compare the costs of different transport options or to calculate the costs per learner.
- Encourage learners to organise a mathematics club where they play board games which require them to count, calculate quantities, and so on.

There are also opportunities to bring outside experiences into school. For example, invite a visitor (e.g. a shop assistant, scientist or nurse) to come in and talk to learners about how they use mathematics in their work.

Parental involvement

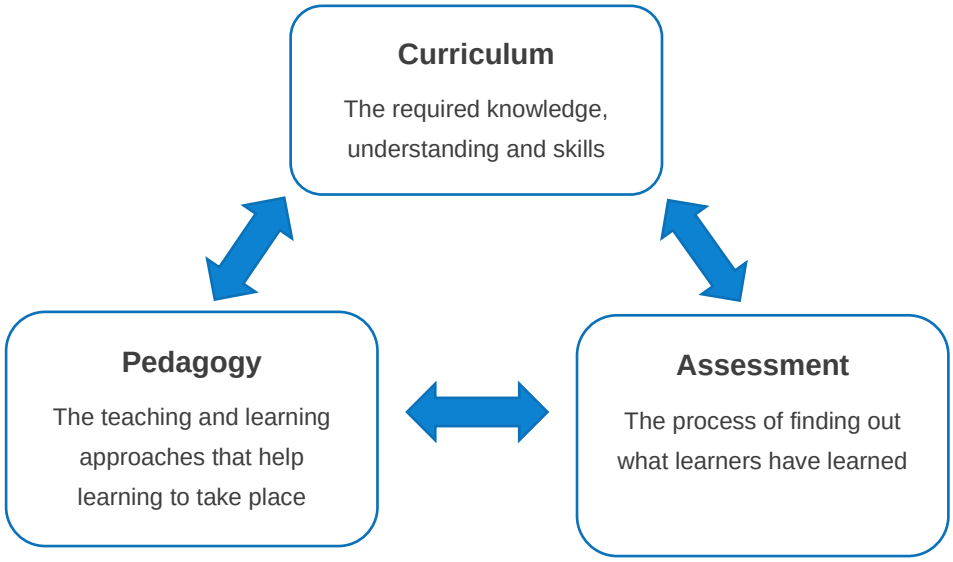
Research shows that there is a clear link between parental engagement in learning and performance in school for learners of all ages. Your school should consider how best to involve parents in their children's learning in your context. This might include:

- communication of the content and skills that learners will cover in a term/semester
- explanation of key teaching and learning approaches that will be used
- general ideas for how all parents can support their children's learning
- specific ideas for how individual parents can support their child's learning
- activities carried out at home that involve exploring everyday contexts with parents
- presentations of learners' work in communal areas of the school and/or at special school events
- opportunities for parents to visit school, for example, to talk to learners about an area of expertise, to help with an activity, or to observe what happens during the school day.

Section 5: Monitoring and evaluation

5.1 Overview

For effective teaching and learning, there needs to be coherence between the curriculum, pedagogy and assessment:

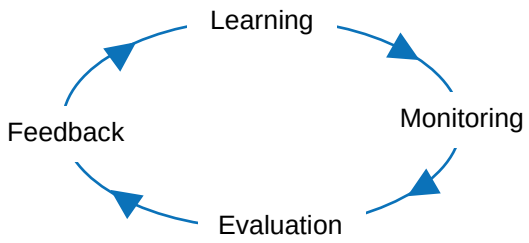


The learning objectives in the Cambridge Primary Mathematics Curriculum Framework define the curriculum (see Section 1.1) and the activities you use in your classroom reflect your pedagogy. This section provides guidance on assessment.

Everyday assessment in lessons is important to enable you to support learners' progress towards achievement of the learning objectives. The sections below discuss:

- learning based on success criteria (Section 5.2)
- some techniques for monitoring progress in order to evaluate next steps for learning (Sections 5.3 and 5.4)
- giving feedback to learners to guide their progress (Sections 5.5 and 5.6).

Together these processes provide a cycle that support effective progress in learning.



Monitoring learning regularly, using a variety of informal methods, enables you to understand your learners' needs and plan next steps which will help them to make progress. For example, you might change your plan for the next lesson(s).

In addition to everyday assessments, it can also be valuable to assess learning over a longer period. Section 5.7 provides information about assessments provided by Cambridge International which cover a stage of learning.

5.2 Developing success criteria

Learning objectives describe what learners should know, understand and be able to do. Success criteria help you and your learners know when a learning objective has been achieved at an appropriate level. By having clear success criteria, learners know what is expected and are engaged in their learning. They have clear goals and can push themselves to achieve the learning objectives.

It is often helpful to display the success criteria throughout the lesson to help maintain focus and help learners to work independently. For example, if success criteria are in the form of 'steps', learners can check their 'success' by following the pathway created by the 'steps'. However, this is not the only approach and sometimes it may be more engaging to 'reveal' the success criteria at other points in the lesson.

You can create and express success criteria in different ways. Before learners start an activity, you might give learners a simple statement of what you expect from them (for example, I will be looking for …). Or you might involve learners in the creation of success criteria for an activity, to give them a clearer understanding of the expected learning.

Giving success criteria a central role in lessons and allowing learners to produce them:

- helps learners to gain a deeper understanding of what to do
- gives learners ownership of the criteria so that they can create a successful 'product'
- gives learners a basis for self- and peer-assessment (see Section 5.6)
- enables learners to become active learners (see Section 3.1).

One way to create success criteria with learners is to provide them with a learning objective for the lesson/activity and a question such as: *How will you know you have achieved this?* Another way is to use samples of work, perhaps from the previous year:

- Select two pieces of work: one that meets all the requirements and one that does not meet all the requirements.
- Ask learners to discuss with a partner what they like about both pieces of work and what could be improved.
- Collect feedback comments. Learners decide on the most important things to think about when they are doing the activity.
- Use feedback comments to produce success criteria.

You may be concerned that there is not enough time in lessons to create success criteria with learners. However, you will quickly discover that the process saves time usually spent on repeating instructions because all learners understand what they have to do and are keen to start the activity. However, even when learners are used to the routine of creating success criteria, you may decide not to use it for all activities.

Like learning objectives, success criteria may be limited to one lesson or may be spread over a series of lessons. There may also be several success criteria for one learning objective.

For example, learning objective **2Gg.03** covers several success criteria:

> **2Gg.03** Understand that length is a fixed distance between two points. Estimate and measure lengths using non-standard or standard units.

Success criteria:

- I can use an object (e.g. my pencil) to measure lengths.
- I can measure the length of a line accurately using a ruler.
- I can guess (estimate) the length of an object or line.

As you observe learners working towards success criteria, you will have many opportunities to monitor the development of their knowledge, understanding and skills. As part of an active learning environment, learners should also regularly reflect on their own learning and progress against the success criteria. Together your observations and learners' reflections will give you lots of information about each learner's strengths and weaknesses. You can use this to inform your future planning.

5.3 Using questions effectively

Questions can be a powerful tool for identifying how learners' knowledge, understanding and skills are developing. You can ask questions before an area of learning to find out what your learners already know and to monitor progress during a lesson or series of lessons. This will help you to decide what to do next (for example, deciding when to move on to a new topic, concept or skill).

Here are some tips and examples to help you make your questioning more effective. Most of the questions you ask will be verbal, but you can also use these tips for written questions:

- **Know your purpose**
  Make you sure you know why you are asking a particular question and what kind of information you are looking for. It is helpful to plan some questions in advance and include these in your lesson plan.

  The table below shows some common purposes, and examples of possible questions for Cambridge Primary Mathematics:

Purpose	Example questions
To get an overview of learners' prior experience before introducing a new concept or topic	*Today we are going to start a new topic on negative numbers. What do you already know about negative numbers?*
To check learners' understanding of particular concepts and decide what to do next	To evaluate learners' understanding of spatial patterns: *What do you notice about how the pattern increases?*
To clarify, extend or evaluate learners' own ideas	*What is the area of this shape? How do you know?*
To clarify, extend or evaluate other learners' ideas	*Eva thinks that $\frac{1}{4}$ is the same as 0.4, which is the same as 4%.* *Who agrees with Eva? Who doesn't agree with her? Why?* *What can you add to that explanation?*
To consider approaches To show a variety of strategies and to make reasoning explicit	*How can you find the answer to 29 x 5?* *How else could you find the answer?* *What are the advantages and disadvantages of the different strategies for this calculation?*
To make connections to prior learning to justify ideas	When starting to add decimals: *What do you already know that could help you with this question?*
To involve the whole class To consolidate ideas	*What do you think about Bessy's strategy?* *Is it more or less efficient than your strategy?*
To inform further inquiry To show a variety of strategies for next steps	*How well can you estimate time? What could we measure to check?* *What could we try next?* *Has anyone got a different idea?*

- **Use open questions more often than closed questions**

Closed questions can be useful to evaluate specific concepts, but open questions invite learners to say more. This often enables you to gather more information about their understanding. Open questions also enable you to stimulate learners' interest and motivate their thinking.
For example, if you ask: *What do you notice about the answers to 45.5 ÷ 5 and 455 ÷ 5? What explanations can you give?* you will generate more valuable information than if you ask learners to calculate each one.

- **Ask one thing at a time**
  Limit your questions to one sentence.
  For example, this question asks both *what* and *why*: *What are the next two number* in *this sequence and why?*
  Instead, ask: *What do you notice about this sequence? So what will the next two numbers be?*

- **Determine the focus, but do not assume a particular answer**
  For example, this question tells the learner that there is an error that needs correcting: *What is wrong with this answer?*
  Instead, ask: *How can you check your answer?*

  As you become more experienced in teaching a particular topic, you will discover some common misconceptions or mistakes. Asking questions to discover whether learners have these misconceptions, or make these mistakes, can be a very useful focus.
  For example, if you ask: *What is the answer to this question* $3 + 4 \times 5 = ?$ you will be able to find out whether learners understand the order of operations.

- **Do not give options unless they are the only options**
  For example, this question makes learners decide between a bar chart and a pie chart only: *Would a bar chart or a pie chart be the best way to represent this data?* The problem with this is that each option might have advantages, and other representations might be even more useful.

- **Allow thinking time**
  Provide learners with time to pause, think and reflect. Avoid expecting learners to answer questions straightaway and instead allow thinking time before taking responses. Similarly allow time after a response before moving on or asking follow-up questions, to give learners the opportunity to both consider the response and add their own ideas or questions.

- **Listen actively**
  Ensure that you listen to the answers learners actually give rather than waiting for your expected answer. Often unexpected answers will give you the most useful information about what learners know, understand and can do.
  Make sure learners do not think that the aim is to tell you the answer you want to hear. If this happens, they will try to 'guess what is in your head' rather than show you their current understanding.

- **Help learners to express their ideas fully**
  Sometimes a smile or a nod can encourage a learner to give a fuller answer. In addition, follow-up questions can help to develop a sequence of thoughts, clarify a learner's answer or engage the rest of the class.
  For example, ask learners to round 5.28 to the nearest tenth (5.3) and the nearest whole number (5). Then say: *How do you know whether to round up or down? How can you be sure that you have rounded the number correctly? Convince your partner that you are right.*

- **Encourage learners to ask you questions**
  To encourage learners to ask you questions, try not to give all the information at once and create a learning environment that encourages learners' questions (see Section 3.3).

5.4 Monitoring individual, pair and group activities

You need to monitor learners' progress throughout lessons, both while learners are working individually and while they are working in pairs or groups. How much you intervene will depend on the age of the learners, but it is important that you do not intervene so much that learners become too reliant on you. Instead, you should allow learners to make mistakes, identify and correct errors, and support each other. This will encourage learners to become more confident and independent.

For group work, part of your role is to ensure that every member of the group is involved: that quieter learners are not excluded, that more confident learners share the responsibilities and that every member shares the responsibility for moving towards the goal. Standing back and observing learners is a good start. You can use your observations to inform follow-up questions or targets for individuals. For example, if an individual is not engaging well in an activity, you can set a small target and a time limit given before returning to observe the individual again:

- 'When I come back in five minutes, I want you to explain how you have …'.
- 'When I come back in five minutes, I will pick one of you randomly to present your ideas. So make sure that you are all confident in your method and explanation.'

However you decide to monitor pair or group activities, it is important that you give all learners time to discuss their ideas, and that you move around the classroom and listen to the language that learners are using.

5.5 Giving feedback

In order to help learners make progress, they need to receive feedback on their knowledge, understanding, skills and effort, and how they can develop them further. All feedback should be specific, constructive and meaningful to learners – it needs to help learners to identify next steps. The most effective feedback occurs when feedback is given as learners work or soon after.

Most importantly, learners need the opportunity to act on feedback and carry out steps for improvement. Without opportunities to reflect, improve and demonstrate evidence of their competence, feedback cannot impact learning effectively.

When you are giving feedback, make sure it links clearly to success criteria and/or learning objectives you have already communicated to the class. Also ensure that your feedback gives the learner enough information to answer the following questions:

- How am I doing? (What progress have I made towards the success criteria / learning objective?)
- What should I do next? (What do I need to do to make further progress?)

Here are some types of feedback:

- **Verbal feedback**
  The most effective feedback occurs when the work is discussed face-to-face. Verbal feedback can be given to an individual, to a group or to the whole class. The language used in lessons has an enormous impact on learners. You should aim to create a learning environment where speaking freely about learning, misconceptions and mistakes is seen as beneficial to learning.

- **Non-verbal feedback**
  We should be aware that we are constantly giving our learners non-verbal feedback through our facial expressions and gestures, for example a smile or a nod of the head. Being aware of our non-verbal communication can help us to develop a positive, supportive learning environment.

- **Written feedback**
  Sometimes it is not practical to give verbal feedback to all learners, and work may need to be marked outside of a lesson. You need to ensure that your written feedback is appropriate for your learners, so they can read and understand your comments. You also need to ensure that you provide learners with time to read and respond to your feedback. Learners need to be clear

about how you expect them to respond to written feedback, for example they could respond by adding to or amending their work in a different colour.

5.6 Self- and peer-assessment

Feedback should not only come from you. It is also important to encourage feedback between learners (peer-assessment). Peer-assessment enables learners to learn from and support each other. It adds a valuable dimension to all learning. The opportunity to talk, discuss, explain and challenge each other, enables learners to progress further than they can unaided. It is important that learners' feedback is supportive and constructive. Your own feedback to learners will help to model effective feedback techniques.

Peer-assessment also develops learners' self-assessment skills. We should encourage learners to use self-assessment continually, so that reflection and improvement become a natural part of the learning process. Self-assessment promotes independent learning and helps learners to take increasing responsibility for their own progress. You could provide learners with a reflection journal where they can record their self-assessment for discussion with you or with peers at key points in the year.

5.7 Monitoring achievement

The previous sections describe ways to monitor progress lesson by lesson. It is also useful to give learners opportunities to demonstrate what they have achieved after a period of study.

As part of Cambridge Primary, end-of-stage, teacher-marked tests (progression tests) are provided for each of the Stages 3 to 6. These are available from the Cambridge Primary support site. Summative end of Primary tests (Cambridge Primary Checkpoint) are also available. These tests are externally marked and centre reports with Certificates of Achievement are issued.

Cambridge Primary Progression Tests
These tests are for use within the classroom to help measure the progress of learners and identify strengths and weaknesses. You can use the tests to assess the learning objectives from the curriculum framework. Analysis of the results of the tests provides diagnostic feedback to the learner on their strengths and areas that require improvement. The analysis of the strengths and weaknesses for the class can be used to reflect on the teaching and prompt changes to the planning for subsequent years.

Lessons following the test need careful planning to incorporate differentiation so that learners can target the particular areas of improvement identified in the reports. The reports may show similar problems for groups of learners which will help with organisation – groupings created for this may change from lesson to lesson. For learners who require more challenge, you could prepare a set of lessons that extend their skills and understanding while ensuring that any areas of weakness are addressed.

You can analyse your learners' test results using the reporting tool available on the Cambridge Primary support site http://primary.cambridgeinternational.org. The site allows you to:

- access the progression tests and store learners' marks
- organise your learners into groups, making it easier to administer the tests and run reports for each group
- use the reports to track learners' progress by comparing individual results against the rest of the class, the school or the average of all learners who have taken the same tests.
- compare results on a year on year basis
- analyse the reports to reflect on your teaching and then focus your efforts where they are needed most
- download your reports to share with other staff and parents.

Cambridge Primary Checkpoint
Cambridge Primary Checkpoint are additional (end of Primary) tests available to Cambridge Primary schools. These are intended for learners at the end of their final year of primary education, when they are around 11 years old. The tests provide an assessment of the learning objectives from Stage 6 of the curriculum framework. These tests are currently available twice a year in April and October.

Schools make entries for their learners using Cambridge International Direct. Cambridge International will then send the examination papers to the school. After learners have taken the Checkpoint tests, the tests are returned to Cambridge International for marking.

Cambridge International provides detailed feedback of the results of the Checkpoint tests, including:

- a centre report
- reports on teaching groups
- individual reports to learners.

Learners also receive an individual statement of achievement.

Details about Cambridge Primary Checkpoint (including past papers) are available from **http://primary.cambridgeinternational.org**

Section 6: Support from Cambridge International

6.1 Resources available from Cambridge International

Cambridge Primary centres receive access to a range of resources when they register. The Cambridge Primary support site at **https://primary.cambridgeinternational.org** is a password-protected website that is the source of the majority of Cambridge-produced resources for the programme. Ask the Cambridge coordinator or exams officer in your school if you do not already have a log-in for this support site.

Included on this support site are:

- the curriculum framework (see Section 1.1)
- grids showing the progression of learning objectives across stages
- schemes of work (see Section 1.4)
- templates for planning (see Section 2.3)
- worksheets for short teacher-training activities that link to this teacher guide
- assessments provided by Cambridge
- a list of endorsed resources which have been through a detailed quality assurance process to make sure they are suitable for schools teaching Cambridge Primary Mathematics worldwide
- links to online communities of Cambridge Primary teachers.

6.2 Training

Self-study training

An online, self-study introductory course is available free to Cambridge Primary centres. It provides an introduction to Cambridge Primary, its educational philosophy and the services, and resources available to Cambridge Primary centres.

Tutor-led training opportunities

Cambridge International runs online training and face-to-face workshops on a range of subjects and teaching and learning approaches throughout the year.

You can see the training courses that are currently available by going to our website **https://www.cambridgeinternational.org** and searching for the 'Events and training calendar'. To find training courses relating to Cambridge Primary, select Cambridge Primary as the 'Qualification type'.

Glossary

This glossary is provided to support your understanding of the content of this teacher guide. The definitions are intended to be sufficient to guide an informed reader.

For more information on important ideas and themes in education, and how to use them in your school, please see the *Getting started with …* interactive resources provided at **https://www.cambridgeinternational.org/support-and-training-for-schools/teaching-cambridge-at-your-school/getting-started-with/**

Active learning – a classroom approach in which learners are encouraged to 'think hard', rather than passively receive information (see Section 3.1).

Closed question – a question that can be answered with 'yes' or 'no', or that has a limited set of short possible answers.

Curriculum framework – the document giving the structure of the curriculum specifying how learning is organised (see Section 1.1).

Differentiation – adaptation of teaching and learning to suit the needs of different learners, and to support progression from their current level of knowledge, understanding and skills (see Section 4.1).

Evaluate – use evidence to inform next steps.

Inclusive learning environment – a learning environment that considers learners as individuals and provides opportunities for all learners to fulfil their potential (see Section 4.1).

Language awareness – understanding of the possible challenges and opportunities that language presents to learning (see Section 3.3).

Learning environment – places where learning takes place, including the classroom, the home and the outdoors.

Learning objectives – statements from the curriculum framework of the expectations of knowledge, understanding and skills that learners will develop; they provide a structure for teaching and learning, and a reference against which to check learners' attainment and skills development (see Section 1.1).

Lesson plan (or short-term plan) – an outline of the teaching and learning activities for a particular lesson (or series of lessons) led by the learning objective(s) for the lesson (see Section 2.2).

Long-term plan – an overview of the coverage of the curriculum framework across the year indicating the available teaching time and its division into terms/semesters, and the knowledge, understanding and skills to be covered in each term/semester (see Section 2.2).

Medium-term plan – an overview of the learning for each term/semester showing a logical, progressive teaching order of the learning objectives, grouped into units; it includes ideas for teaching and learning activities to deliver the learning objectives (see Section 2.2).

Metacognition – awareness of one's own mental processes; the process of getting learners to plan, monitor, evaluate and make changes to their own learning behaviour.

Monitor – observe learners' performance and progress during an activity or over a longer period of time without getting actively involved.

Open question – a question that elicits a longer answer than a closed question, reflecting the respondents' understanding or thoughts.

Peer-assessment – when learners assess and give feedback on each other's work.

Reflect – think about what went well and not so well; think about your learning.

Scheme of work – support materials produced by Cambridge International for each stage of Cambridge Primary Mathematics. Each scheme of work contains a suggested long-term plan, a medium-term plan with suggested teaching and learning activities and sample short-term plans (see Section 1.4).

Self-assessment – when individuals reflect on their own performance and progress.

Short-term plan (or lesson plan) – an outline of the teaching and learning activities for a particular lesson (or series of lessons) led by the learning objective(s) for the lesson (see Section 2.2).

Spiral approach – an approach in which areas of learning are revisited systematically so learners can engage in more depth and in different contexts.

Strand – a collection of learning objectives in the curriculum framework that form an area of learning (see Section 1.1).

Sub-strand – sub-sections in the curriculum framework which divide the strands into more specific areas for teaching and learning (see Section 1.1).

Success criteria – descriptions of how learners can demonstrate achievement of a learning objective (or part of a learning objective); they help learners to know if they have been successful in achieving the learning objective at an appropriate level (see Section 5.2).

Talk partner – a classmate with whom a learner discusses the answer to a question before responding (see Section 3.3).

Unit (of work) – in a medium-term plan, a group of learning objectives and activities based around a topic or theme and covering a series of lessons.

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