YEARS 11&12

PRELIMINARY MATHEMATICS

TEACHING & LEARNING GUIDE

INDEPENDENT SCHOOLS TASMANIA

TASMANIAN CATHOLIC education office

Tasmanian Government

Preliminary Mathematics
Teaching and Learning Guide

TABLE OF CONTENTS

ADVICE TO TEACHERS

This document helps to describe the nature and sequence of teaching and learning necessary for learners to demonstrate achievement of course outcomes.

It suggests appropriate learning activities to enable learners to develop the knowledge and skills identified in the course outcome statements.

Tasks should provide a variety and the mix of tasks should reflect the fact that different types of tasks suit different knowledge and skills, and different learning styles. Tasks do not have to be lengthy to make a decision about student demonstration of achievement of an outcome.

COURSE SPECIFIC ADVICE

This Teaching and Learning Supplement for Preliminary Mathematics must be read in conjunction with the Preliminary Mathematics course document. It contains advice to assist teachers delivering the course and can be modified as required. This Teaching and Learning Supplement is designed to support teachers new to, or returning to, teaching this course.

SEQUENCE OF CONTENT

Preliminary Mathematics is organised into four sequential stages. Learners can enter the course at any of the four stages depending upon their level of readiness or ability. Providers will determine the entry point for learners.

Course Delivery

The sequence of delivery for each stage is at the discretion of the provider. A personalised learning program will be developed for each learner, dependent on their needs. Not all learners will achieve all stages of the course content.

While there is no prescribed order of delivery within each stage, the course material from each content strand must be completed and assessed against criterion 1 (number and algebra), criteria 2-3 (measurement and geometry) and criterion 4 (statistics and probability). To support effective learning it is recommended that providers design a program of study that combines/concurrently delivers the content in criterion 1 alongside the content in criteria 2-4. While not all proficiency strands apply to every part of the course content, they provide a meaningful basis for the development of concepts within mathematics and as such indicate the breadth of mathematical actions that teachers can emphasise to support learning of the prescribed content.

TEACHING AND LEARNING

Stage 1

EXAMPLES OF LEARNING ACTIVITIES

With co-active assistance, learners:

- Participate in familiar activities (eg songs, games, stories) that involve counting and/or making groups

- Experience and respond to names, symbols and quantities of number in everyday activities (eg storytelling during circle time, counting/grouping objects).

- Indicate a need/want for 'more' or 'less' and/or choose one group over another (eg choosing the larger collection of toy cars)

- Respond to practical situations of sharing (eg distributing items equally through one-to-one correspondence)

- Participate/experience 'exchange of money for goods' situations through play (e.g. role-play or storytelling)

- Match photographs of familiar places with the correct name (names may be read as required)

- Respond to picture cues on a daily organiser

- Participate in class activities involving measurement (eg pouring drinks, filling buckets, cutting cardboard, measuring lengths of string)

- Use playdough to create copies of different shapes from a template

- Use Tangram pieces to create different shapes/objects on a template (eg Osmo Tangram iTunes app)

- Explore a range of objects that have various properties including length (eg order from shortest to longest)

- React to two-dimensional objects in everyday situations with the use of sensory input (eg build, stack, construct, order, classify)

Stage 2

EXAMPLES OF LEARNING ACTIVITIES:

With co- active assistance, learners:

- Participate in activities (eg songs, games, stories) that involve counting and/or making groups including the use/notion of zero (e.g. 3-2-1 Blastoff!, Five Little Ducks, Baa Baa Black Sheep, completing dot-to-dots)

- Respond to and use names, symbols and quantities of number in everyday activities (eg storytelling during circle time, counting/grouping objects).

- Share materials equally amongst groups using one-to-one correspondence (eg share marbles equally amongst five groups).

- Follow instructions to move items in ones and respond to questions about group composition (eg pass Shane one toy car. Who has more cars?)

- Investigate the volume of different containers (eg how many pebble fit in each size pot?)

- Identify, match and order activities with time of day (eg eating breakfast, sunset, going to bus-stop)

- Measuring ingredients for cooking using simple recipes

- Describe how to get from point A to point B (eg from the classroom to the Library)

- Match coins by size, colour or against a template

- Participate in 'exchange of goods for cash' simulations and roleplays (eg Café, Grocer, Canteen)

- Experience goods or services being paid for using 'paypass' or other features of a bank card

- Use playdough to create different shapes by name

- Use polyonimoes to create different shapes/objects on a template (eg Zentominoes iTunes app, Dominoes pieces)

- Order objects by various properties including length (eg order from shortest to longest)

- Use two-dimensional objects in everyday situations with the use of sensory input (eg build, stack, construct, order, classify

Stage 3

EXAMPLES OF LEARNING ACTIVITIES:

With co- active assistance, learners:

- Play games that involve counting forwards and backwards (eg Snakes and Ladders, Ludo, Sorry) and the recognition of quantity (eg on a dice, on playing cards or Dominoes).

- Participate in songs, rhymes, games and stories that require counting forwards and backwards.

- Use sight-cards, number name and numerals to identify groups up to 5 and to compare two groups as 'same/equal', 'more' or 'less'.

- Participate in role-play or story-telling situations involving the exchange of coins for goods or services by matching with templates e.g. Pay $3 for a container of milk.

- Recall in order, steps in a procedural task e.g. making jelly, a kite, planting a tree. Investigate the steps in procedure by taking photos. Put the jumbled steps of the procedure in the right order.

- Select the appropriate equipment to conduct measurements e.g. by matching equipment with task.

- Use visual organisers to sequence the days of the week and to order activities within a school-day.

- Predict what new picture symbols might mean on daily organisers or on other information sources such as weather charts, maps and information brochures.

- Describe 2-Dimensional shapes not in sight (eg through a Mystery bag / box).

- Create a sequence of instructions to move around a familiar place e.g. School / Shopping Mall.

- Follow a sequence of instructions to move around a familiar place and identify local or school landmarks in photographs or in person.

- Predict an activity based upon a collection of objects (eg sun hat, bucket and spade, towel – going to the beach).

- Experience and engage in conversation involving data (e.g. looking at the website I can see that the movie screens at 9:40 and at 11:10. It will take us 20 minutes to travel from school and we are leaving at 9:00. Which time would be better?)

Stage 4

EXAMPLES OF LEARNING ACTIVITIES:

With co- active assistance, learners:

- Play games that involve counting forwards and backwards and the recognition of quantity (eg Dominoes, Snap, Uno, Snakes and Ladders, Fairway Solitaire iTunes App).

- Use concrete materials (eg counters) to model situations involving taking away and record using symbolism including the subtraction sign.

- Create a poster demonstrating all of the different ways that two whole numbers can be added together to create 10.

- Match Australian coins to 2-Dimensional images using templates.

- Create 3-Dimensional objects using materials such as icypole-sticks, paper nets, pipecleaners or hinged plastic polydrons

- Name, sequence and identify attributes of months and seasons of the year

- Participate in dances or activities involving sequenced steps

- Record key dates on a calendar or planner (eg student birthdays)

- Participate in treasure hunts

- Measure the growth of seedlings over time and organise the data into table and graph form

- Organise a survey involving categorical data (eg favourite food, mode of transport to school etc.)

- Organise responses to a survey into different categories and create a picture graph

- Use pattern blocks to create shapes/patterns following instruction (written/verbal)

SUPPORTING STUDENT RESPONSES AND ELABORATIONS

Knowing your learners – Key messages

Learning is a social collaborative undertaking that happens in a classroom community.

Developing positive and respectful relationships forms the basis for building strong classroom communities. An integral part of building those relationships lies in getting to know the backgrounds, talents, needs and aspirations of your learners.

This can include an undertaking to:

- Find out their strengths, what they are passionate about and their goals.

- Know about their cultural and language background.

- Know about social disadvantage or trauma that may be part of their background.

- Understand their needs; including medical, personal, physical, communication, sensory and learning needs.

- Create opportunities for learners to get to know one another and appreciate the diverse qualities they bring to the classroom.

- Model and teach about wellbeing, mutual support and respectful interactions.

- Find out where learners are up to in their learning with respect to the curriculum.

Getting to know learners with disability

Sometimes getting to know learners with disability or complex health needs may seem a little daunting. However, getting to know the student as an individual, as well as their health and care needs, is key to personalising their learning programs. Start with the student and seek information from them in terms of their aspirations, support needs and details on what has worked well for them in the past. If the student is unable to convey this information, then the student's family are a key point of contact.

Note too that information such as existing Individual Education Plans, professional reports and anecdotal summaries may be stored in the Student Support System, providing a good outline of strengths, interests and needs. Check with the support staff in your school to help develop an up-to-date and complete picture of the student that can readily inform their teaching and learning programs.

Keep in mind that learners with disability are heterogeneous, and expressions of any disability are likely to be different in any two learners. Some learners will not have an identified name for their disability other than 'global' or 'developmental' delay. Some learners will have multiple disabilities.

What are the best sources of information?

If the student is not able to convey their needs, strengths and interests, the student's family will have a wealth of knowledge about their child and the disability. They can often direct you to good sources of information. Some schools use parents and their contacts to inform staff, and in some situations the student body about the disability.

Pre-assessment

As well as knowing who their learners are as learners, it is important that teachers know where they are up to in their learning. This allows learning experiences to be planned so that they are challenging, without being so difficult that learners feel overwhelmed.

Pre-assessment is formative assessment done with learners before any teaching occurs. It is used to inform planning and to differentiate according to learners' current level of understanding.

Thus, pre-assessment strategies and techniques allow teachers to gain insight into the background knowledge and skills that learners already have relating to a topic before they teach it.

Carefully designed pre-assessment can ascertain learners' current level of achievement and identify any gaps in essential knowledge or misunderstanding that they might hold.

This information is used by the teacher to inform decisions about:

- where to begin the teaching and learning
- who needs revision and how much
- who needs scaffolding or teaching for missing essential skills
- the pace of learning
- who has already achieved significant aspects of the topic and requires extension/enrichment
- how groupings of learners might be formed for the topic

The first step in planning for learning is to have an understanding of the curriculum scope and sequence for the learning area and the expected learning outcomes.

Identifying goals for learning.

To support learners to achieve greater learning independence, we need to communicate to them:

- what they are going to learn - learning intentions
- why they should learn it in the first place - reasons for learning
- how they will recognise when they have succeeded - success criteria

Pre-assessment techniques

There is an enormous range of both formal and informal pre-assessment techniques and tools available for teachers to use. The pre-assessment technique or tool a teacher selects will vary depending on:

- the nature of the content to be taught
- whether they need individual, small group or whole group information
- the time available and relative efficiency of different techniques

Making adjustments to teaching

Using the information collected from pre-assessment tasks will include looking for common, powerful differences in student responses with respect to their current knowledge and skills, interests or preferred way of learning.

This information can be used as the basis for flexible groupings of learners and to inform the design of the tasks that different groups engage with.

Formative assessment

When designing a program of work it is important that teachers find out what learners already know, understand and can do, as well as uncovering any misconceptions they have developed. This will involve using the formative assessment strategies and tools.

Knowing your learners: questions for reflection

- What information can I source from the student data that informs my understanding of my learners; e.g. existing learning plans, curriculum assessment reports, attendance data, specialist reports, communication with parents and wellbeing data?

- What are some creative ways I can use existing school processes to know my learners better?

- How can I make time and create opportunities to get to know my learners?

- Which specialists may have relevant background information about my learners?

- In what ways can I communicate positively and effectively with each student's family?

- What are my learners' current interests and how can I tap into them?

- What are the priority individual's and group's needs?

- What are the dominant attitudes and dispositions that significantly impact on each student's engagement or attention? How might these be improved?

- In what activities do the learners achieve success?

- What information can we gather from listening to student questions and watching their actions in class?

DIFFERENTIATION STRATEGIES FOR PERSONALISING LEARNING

Overview

Differentiated classroom learning recognises that some learners require significant personalisation of their learning programs to be fully engaged and challenged.

Some learners will require adjustments that extend and enrich their learning. Some will require considerable support and others may require targeted support or systematic teaching to overcome barriers such as learning English as an Additional Language or Dialect (EAL/D) to enable their engagement, learning and achievement.

Adjustments include any measure or action to promote access, engagement and optimise student learning outcomes. Adjustments and/or extensions vary according to the needs of the learners. They may be minor or significant. In some instances, such as learners with disability, they may be designed and developed as part of a collaborative planning meeting.

Adjustments can be made to:

- content (what is to be taught)

- process (how learning will occur)

- product (evidence of student learning).

Content differentiation - Key messages

Content can be differentiated through:

- Making adjustments to the content described in course documents.

- Choosing learning resources and stimulus materials that meet a student's preferred mode of learning and stage of development.

- Using technology to locate and provide content at a range of levels and in modes that engage and support learning.

Process differentiation - Key messages

"Note that differentiation relates more to addressing learners' different phases of learning from novice to capable to proficient rather than merely providing different activities to different (groups of learners)." (Hattie 2009)

TEACHING STRATEGIES

Teachers who differentiate select the most appropriate strategy for a task to facilitate each student's engagement and learning. This might happen when planning a lesson, or even in response to a student's needs during a lesson.

Differentiated teaching is often referred to as 'responsive' teaching, reflecting the way in which a teacher moves from using one mode to another as required.

TASK DESIGN

Teachers also design authentic and relevant tasks for learners so they can actively engage with the concepts, information and skills identified in the curriculum.

Tasks that have a number of entry points and directions lend themselves well to differentiation.

Tasks can be differentiated by pre-planning prompts, questions and supports that will enable and support learning for those learners experiencing difficulty, and that increase the degree of challenge and complexity for those learners who need extension.

Effective process differentiation strategies for all learners include:

PEOPLE

- Developing solid partnerships that support the student.
- Taking account of and valuing learner differences.
- Drawing on prior learning and extending background knowledge. For some learners it may be important to supply them with background knowledge they are missing.
- Varying learning activities to promote and support different learning styles and preferences.
- Building opportunities for learners to work in teams, sharing roles and building on from their individual strengths.
- Having fun with learning.

SCAFFOLDS

- Developing language and new vocabulary.
- Supporting learning with the provision of scaffolds.
- Clearly displaying learning intentions and key concepts/skills.
- Removing unnecessary distractions.
- Providing organisational support.
- Allowing time for learners to process information and ask questions.
- Providing opportunities to practise the new skill or knowledge.
- Incorporating student interests and allowing them choice in some aspects of the learning or assessment.

ENVIRONMENTAL SUPPORTS

- Including visual cues in the environment and teaching all learners to use these.

- Providing clear routines for smooth transitions and structured and predictable learning experiences.

- Explicitly teaching positive behaviours and encouraging learners to apply the skills they learn.

- Providing multisensory inputs, actions and expressions.

- Providing models of problem solving, verbalise the thought processes and support with guided practice.

- Using concrete models and examples of what success looks like.

- Using human resources effectively at the planning and delivery stages - thinking about peers, teacher assistants, specialist staff, and other classroom teachers.

- Engaging technology to improve access to information, processing information and demonstrations of student understandings and skills.

ONGOING ASSESSMENT

- Encouraging learners to plan, monitor and evaluate their own learning by checking and testing for understanding.

- Giving feedback that is timely, specific, clear and related to the learning intentions (What worked? What's needed? What next?).

- Allowing learners opportunities to put the feedback into action.

- Providing opportunities to celebrate student success, and share work and learning.

PRINCIPLES AND STRATEGIES OF TASK DESIGN

Designing group tasks ensures that every student can access and learn from a rich and varied curriculum, and has to think about and apply essential ideas and skills. Some tasks may need to accommodate opportunities for some learners to work on their personal goals as described in their Personalised Learning Plans.

There are some general principles and strategies that can be applied to task design that include:

- Know where learners are up to in their learning.

- Prerequisite knowledge and skills.

- What they understand and misunderstand.

- The degree they have mastered or surpassed expectations.

- Which teaching strategies work well for them.

- Whether they can connect key ideas to their lives and experiences.

- Identify appropriate expectations (KUD) informed by the course content and assessment criteria.

- Plan to stretch learners who are most advanced and scaffold the task for learners requiring additional support to work with the key ideas and skills as identified learning goals (Tiered task design).

- Address diverse levels of thinking and abilities through the use of tasks that have more than one right answer or way to solve a problem.

- Draw on a variety of media - ensure that written content is accessible to everyone.

Product differentiation - Key messages

A key principle of differentiation is that it removes barriers and limitations to learning.

This must also apply when it comes to enabling learners to demonstrate what they really know, understand and can do, through the products they create.

A lack of skill with a tool or genre, such as a hand written essay, can mask the true level of understanding a student has developed.

For formative assessment purposes, alternatives may need to be considered to gain accurate insight into their learning progress.

Tasks that are differentiated to take account of each student's needs, strengths and interests may result in a range of different artefacts being produced.

When designing tasks and their associated products teachers can consider:

- A common learning task may be differentiated just in the products created through the learning.

- A student's level of skill with tools used to communicate their learning needs to be taken into account.

- Technology tools can be powerful enablers for differentiating the products that result from learning tasks.

- Providing choice and flexibility in the tool used to create products of learning allows learners a voice in their learning.

The learning environment can also contribute to differentiation in significant ways.

Adjustments may be made to one of these aspects of learning, or to any combination that makes sense in the context.

Not every aspect of every lesson will be differentiated. Ideally it is targeted to have the most significant impact on a student's learning.

A teacher's skill in differentiating develops with:

- Experience in applying a broad repertoire of teaching strategies in flexible ways.

- Access to a range of resources for learning.

- Capacity to manage a classroom with diverse learning activities happening simultaneously.

Assistive Technologies - An Explanation

WHAT IS MAINSTREAM TECHNOLOGY?

Mainstream technology is described as products used widely in the mainstream such as laptops running Windows or Mac operating systems, iPads and Smart phones.

WHAT IS EDUCATIONAL TECHNOLOGY?

Educational technology aims to support the attainment of student learning goals. Technology tools can be powerful enablers for learners in terms of processing information and showing their understanding or skill. Some examples of educational technology include: Interactive White Boards, **digital storytelling**, **mind mapping** and web based learning programs.

WHAT IS ASSISTIVE TECHNOLOGY?

Assistive technology is a term that covers a range of technology aimed at helping learners with disability participate, communicate and achieve in teaching and learning programs. Despite the word 'technology' not all

assistive technology is high tech. Assistive technology ranges from simple adaptive tools, such as calculators and pencil grips, to high tech tools like speech to text software.

Assistive technology is adapted to suit the needs of the student and includes tools such as:

- e-books with audio files that can read text or put text from a computer screen into speech

- Timers - help learners develop a sense of time for tasks and prepare for activity to activity transitions

- Seat cushions to help with sensory processing and attention issues

- Calculators

- Writing supports such as a pencil grip or a computer for typing

- Graphic organisers to help learners plan their writing or capture and sort the main ideas from a reading or information presentation.

High Assistive Technologies include:

Language Acquisition through Motor Planning (LAMP) device, and switch- activated toys

The starting point for planning assistive technology supports for learners is a conversation with the Physical Impairment Coordinator in your Learning Services.

Complete an ICT Information Technology Assessment Profile.

Once you have had a conversation with the Physical Impairment Coordinator in your Learning Services you may need to apply for technology supports.

The SETT Framework is another tool used to identify the most effective assistive technology decisions. This framework takes you through several steps that help clarify the student's strengths and needs, the environment/s, tasks required for active participation and the system of tools needed.

Teaching Strategies

- Getting to know your learners

- Integrate to differentiate

- Evidence based teaching strategies:

  » Clear lesson goals
  » Show and tell
  » Questioning to check for understanding
  » Summarise new learning in a graphic way
  » Practise
  » Feedback
  » Be flexible about how long it takes to learn
  » Collaborate
  » Strategies not just content
  » Nurture metacognition

- Explicit teaching is an instructional strategy used by teachers to meet the needs of their learners and engage them in unambiguous, clearly articulated teaching. Teachers plan for explicit teaching to make clear connections to curriculum content through a concise focus on the gradual and progressive steps that lead to a student's development and independent application of knowledge, understanding and skills of the course content.

- Information on explicit teaching is found at https://www.teachingacenglish.edu.au/explicit-teaching/overview/explict-overview.html

- Differentiating teaching and learning requires knowledge of each student's background and experiences, interests, readiness and learning needs. Teachers use this knowledge to plan and implement curriculum, teaching strategies, learning experiences and assessments that provide multiple pathways for learning for every student. This ensures all learners have equitable access to curriculum and are able to demonstrate success.

- Knowing your learners is the key to differentiating teaching and learning – what they know and can do, what they need to learn next and how best to teach them and monitor their progress. Information on differentiation is found at https://www.teachingacenglish.edu.au/differentiation/overview/differentiation.html and through the Good Teaching Resources: Differentiated Classroom Practice Learning for All at https://www.teachingacenglish.edu.au/differentiation/overview/differentiation.html

RESOURCES

Websites

Wordle is a Web 2.0 tool that generates 'word clouds' with text that the user provides

Language games – Sheppard Software games

Inside a dog Welcome to a site about books - by young people, for young people. Inside a Dog is a place for teen readers. Use it to find great reads, to share reviews of books you have read, to join a book club and hear thoughts and tips from published authors

Visual Dictionary Online

Woodlands Primary: Literacy Zone Interactive literacy games for spelling, grammar, punctuation and writing

Nina Loves to Name Things; interactive game Pick a place and help Nina to name things associated with that place in this language game. Click and drag images as you hear how to pronounce the name

Endless Alphabet: iPad app An educational app that teaches ABC's and builds vocabulary. Each word features an interactive puzzle game with talking letters and a short animation illustrating the definition. Please note: there is a cost for this app

Dr.Suess's ABC: iPad App The classic book "Dr. Seuss's ABC" comes to life with delightful animations and learning activities! Please note: there is a cost for this app

Read Write Think- construct a word Combine letters to make words, and learn about beginning and ending sounds in words when reading

The ConnectAbility website has lots of tips and templates for creating visual supports for the classroom.

A collection of printable Graphic Organisers

A comprehensive library of Graphic Organisers

Teaching practices for reading and viewing Victorian Department of Education

Picasso Head This digital tool is intuitive and user friendly. The program works by dragging facial elements onto an online drawing canvas

Fluid Painter is a free art tool. However learners must save their work using a screen capture into Word or PowerPoint

Making Memes

Text ideas

[Rewordify](#) a tool that lets you copy and paste any text (or any type in any website), automatically identifies more challenging words, and then provides simplified words to replace them. Depending upon the settings you choose, those simplified words can replace the actual ones, be able to be seen with a click of the mouse, or be shown next to them. While not perfect in every single instance, it seems extremely sophisticated, and provides good accuracy of the simplified word choices. The site also provides a large number of classic literature texts that have been simplified using this tool

[Storytelling](#) Oral histories, myths, legends, folk tales, fairy tales, Aussie yarns and interactive digital stories. Storytelling traditions stretch throughout time

[Dust Echoes](#) is a series of twelve beautifully animated Dreamtime stories from Central Arnhem Land, telling stories of love, loyalty, duty to country and Aboriginal custom and law

[Little J and Big Cuz](#) Television show provided insight into traditional Aboriginal culture, country and language

[Super stories: The Abandoned House](#) Help a publishing director create a bestselling horror story. Read the story. Choose effective verbs and adverbs to increase the impact of the story by making it scarier. Select illustrations that highlight the horror of the events. This learning object is one in a series of four objects

[Storyonline](#) Storyline Online is a video program featuring famous actors reading childrens books aloud. Each book includes accompanying activities and lesson ideas

[Stick Figure Hamlet](#) can be used for a quick overview of the play, or as a model for summarising other works.

TED Lesson – Spoken Word Poem – [To This Day Project – Shane Koyczan](#)

'*The Arrival* is a migrant story told as a series of wordless images that might seem to come from a long forgotten time.[The Arrival Part 1](#) Part 1 and [The Arrival Part 2](#)

Mirror by Jeannie Baker. Written and illustrated by Jeannie Baker, *Mirror* comprises parallel stories about the lives of two boys one in Australia and one in Morocco. The Australian boy's story is written from left to right in English, and the Moroccan boy's story is written in Arabic, which reads from right to left. – [Lesson Plans](#)