

# Teaching Secondary Mathematics

## Module 1

Overview of learning in the  
Mathematics Domain

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# Program Overview:

## Teaching Secondary Mathematics

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The Teaching Secondary Mathematics Resource provides support and guidelines for effective practice for classroom teachers and school leaders of mathematics, especially from Years 7–10.

This resource is for:

- all secondary mathematics classroom teachers to deepen their understanding of mathematics. This will inform their planning for mathematics and highlight opportunities for assessment of mathematics in other domains of the Victorian Essential Learning Standards (VELS)
- mathematics leaders in schools to plan opportunities for professional learning for the teachers of mathematics, in professional learning teams and/or for individual teachers
- differentiating the professional learning needs of mathematics teachers in schools.

### Background

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The Teaching Secondary Mathematics Resource responds to the findings of the Parliament of Victoria's Education and Training Committee's *Inquiry into the Promotion of Mathematics and Science Education* in 2006. The inquiry recommended that all Victorian schools give higher priority to Mathematics and Science learning and teaching. The report noted that whilst there are currently some excellent outcomes in Victorian schools, there is a broad range of performance among students in mathematics. A need to provide opportunities to increase student engagement in Years 7 to 10 was noted, along with imbalances in participation and achievement of some groups of students. The inquiry stated that there is considerable scope for raising the achievement of the best students and in providing support to improve the performance of under-achieving students. This resource provides teachers with current research and strategies to address some of these concerns.

### Program aims

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The underlying purpose of this resource is to support schools and teachers make a difference to:

- Each student's achievement in mathematics
- Each student's experience of learning mathematics. This includes feelings of satisfaction with meeting challenges, being valued as a person, learning things that have meaning in your life and getting rewards for making significant efforts.
- Each student's capacity as a learner. Making sure that mathematics contributes to the growth of the whole person: in the long term as a citizen with sufficient numeracy to live a fulfilling life contributing to the community; and immediately as a classroom member who interacts well with others, and assists in making school life productive.
- Each student's growth as a community member. Mathematics (and other subjects) should offer students experiences that increase their capacity to learn through ability to work independently, and their enhanced thinking and meta-cognitive processes.

## **Program content and organisation**

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This program provides many options and ideas that have proved beneficial to some teachers. However, as usefulness depends on the particular circumstances of each school, community and student population, not all ideas will be appropriate to all teachers. Each school can chart its own pathway through the program, exploring areas of particular interest and value for its own needs and purposes.

The Teaching Secondary Mathematics Resource consists of nine separate modules. It is recommended that all teachers complete Module 1: Introduction module and the concluding Module 9, 'Planning for improvement in mathematics'.

### **Module 1: Overview of learning in the Mathematics Domain**

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The introductory module orients teachers to the 'Teaching Secondary Mathematics' resource and provides an overview of effective mathematical pedagogies, the need for teacher's to build their craft, and how effective teaching reflects many of the initiatives currently being promoted by Department of Education and Early Childhood Development (DEECD).

In the work undertaken by teachers and researchers it is seen that a number of pedagogical and mathematical themes have been found to be significant in improving learning outcomes for secondary students. Seven modules of the program are therefore dedicated to helping schools explore each of these themes. The concluding module explores how schools can plan for improvement in mathematics teaching.

### **Module 2: Overview of the Mathematics Developmental Continuum P–10**

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This module will inform teachers about the Mathematics Developmental Continuum P–10. It provides an outline of the main features of this Resource. The starting point is :

[Mathematics Continuum main page](http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/default.htm) (<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/default.htm>)

### **Module 3: Narrowing the achievement gap: Focus on Fractions**

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The topic of fractions is a notorious hurdle that many students do not get over, effectively preventing them from meaningful participation in further mathematics learning. This module showcases how using diagnostic tests as assessment for learning, together with targeted teaching, can help students learn fractions with understanding in a meaningful way. This opens the door to future success.

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## **Module 4: Conducting practical and collaborative work: Focus on contours**

This module uses the topic of Contours from the Space dimension of VELS to illustrate aspects of using practical work in mathematics for engaging students in collaborative work. There are also many links to skills required outside school.

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## **Module 5: Understanding students' mathematical thinking: Focus on algebra and the meaning of letters**

This module illustrates how teaching becomes more responsive to students' needs when the teacher understands students' mathematical thinking and their common misconceptions.

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## **Module 6: Using a range of strategies and resources: Focus on percentages**

This module examines several resources used for teaching about percentages, and demonstrates a range of strategies to support the different ways in which students think and learn. These resources include: the Mathematics Developmental Continuum, Digilearn learning objects, Scaffolding Numeracy in the Middle Years and Assessment for Common Misunderstandings tools.

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## **Module 7: Learning through investigation: Focus on chance and variability**

This module focuses on chance and variability to illustrate key points about teaching mathematics through investigations. The main mathematical content is the contrast between short-run variability and long-run variability.

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## **Module 8: Working mathematically: Focus on a range of challenging problems**

Having a good appreciation of working mathematically is an important part of achievement in mathematics. Moreover, the processes of investigation, inquiry and explanation involved in working mathematically build each student's capacity as a learner. These are all important outcomes of schooling.

This module explores these issues in the context of some intriguing mathematical problems.

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## **Module 9: Conclusion: Planning for improvement in mathematics**

This module reviews the themes in the Teaching Secondary Mathematics Resource and provides an opportunity to start planning change in the teaching of mathematics in the school using a lotus diagram planning tool.

# Introduction to Module 1: Overview of Learning in the Mathematics Domain

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This module is designed to introduce the Teaching Secondary Mathematics Resource and to orient teachers to its use.

There is a need to improve mathematics learning for all students and to narrow the gap of achievement within groups of students. Module 1 is directed to teachers of mathematics who would like to deepen their understanding of effective mathematical pedagogies. The key messages underpinning this module are:

1. Improving mathematics learning in schools requires teachers to know each student's level of mathematical understanding, knowledge and achievement: as well as their experience of learning mathematics. Teachers need to ensure that mathematics contributes to the growth of the whole person.
2. Mathematics (and other subjects) should offer students experiences which increase their learning capacity.
3. There is a need to improve mathematics learning for all students and to narrow the gap of achievement within groups of students.
4. Australia performs well in international tests, but some other countries perform considerably better. Research shows that effective schools and teachers can markedly improve the achievement levels of students.
5. Assessment for learning and teaching is a key to improvement. The Mathematics Developmental Continuum P–10 provides detailed information to assist in assessment for learning.
6. Effective teaching of mathematics reflects many of the Principles of Learning and Teaching P–12.
7. Mathematics has a substantial role to play in addressing learning beyond the Mathematics Domain. In the Interdisciplinary Learning strand, it can make a unique contribution to students' learning in the Thinking Processes and Information and Communications Technology domains. In the Physical, Personal and Social Learning strand, it is strongly linked to the domains of Interpersonal Development and Personal Learning.

## Use of this module

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This module allows for flexibility in modes of engagement with professional learning. The module booklet needs to be used in conjunction with the PowerPoint slides accompanying this resource.

## Workshop approach

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The materials of this module can be used by a presenter in a workshop for a school or a cluster of schools. A presenter, appointed from within or outside a school or cluster, is responsible for preparing presentations, facilitating discussions and outlining processes for collaborative planning.

Where a group is working collaboratively through these modules, a designated area is required for participants to share ideas, stories and samples in a climate of mutual respect. Regular after school meetings in a particular venue, such as the library, create a productive sense of community.



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## Individual use

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The materials in this module are also suitable for private study and reflection. Individual users become both 'presenter' and 'participant'. While they are not able to engage in group discussions or whole-school planning, individual users can readily adapt the suggested group discussions and whole-school planning activities to private reflection, writing and classroom planning.

It is suggested that individuals identify a colleague or a buddy with whom to share their thoughts and to support the development of their understandings through ongoing dialogue. Individuals may complete all the modules or choose a combination depending on their interests or needs.

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## Web connections

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The 'Teaching for Secondary Mathematics' resource is located at <http://www.education.vic.gov.au/studentlearning/teachingresources/maths/teachsec/default.htm>.

Before commencing to plan any elements of the program, schools are strongly advised to visit the Mathematics Domain page to review the most up-to-date advice, resources and information relevant to each module of the program. Many elements of this resource are available online in a downloadable format. There are links to assist schools to locate relevant information.

[Mathematics Domain](http://www.education.vic.gov.au/studentlearning/teachingresources/maths/default.htm) (<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/default.htm>)

See the website for further details about this additional information or contact the student learning help desk on [studentlearning@edumail.vic.gov.au](mailto:studentlearning@edumail.vic.gov.au)

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## Content of the module

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This module comprises Module 1– Introductory booklet and the accompanying slide presentations which can be downloaded from <http://www.education.vic.gov.au/studentlearning/teachingresources/maths/teachsec/module1.htm>

The following are included in this document:

- the **User's Guide** that assists the user through the professional learning program
- hard copies of the **slide presentations** and **resource sheets**
- selected **resources**.

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## Organisation of the module

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Computer access is required for all modules. If a group is completing the modules, a data projector and tables that enable people to sit together and work collaboratively are also necessary. The presenter should encourage participants to raise questions throughout the ensuing presentation. This presentation should take approximately one hour, depending on the depth of discussion and types of activities that facilitators incorporate.

## Required resources

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This module requires the resources listed below.

### Relevant Victorian Essential Learning Standards domains:

- [Thinking Processes](http://vels.vcaa.vic.edu.au/essential/interdisciplinary/thinking/index.html) (<http://vels.vcaa.vic.edu.au/essential/interdisciplinary/thinking/index.html>)
- [Interpersonal Development](http://vels.vcaa.vic.edu.au/essential/personal/development/index.html) (<http://vels.vcaa.vic.edu.au/essential/personal/development/index.html>)
- [Personal Learning](http://vels.vcaa.vic.edu.au/essential/personal/learning/index.html) (<http://vels.vcaa.vic.edu.au/essential/personal/learning/index.html>)

### Handout:

- [Professional Learning in Effective Schools -The Seven Principles of Highly Effective Professional Learning](http://www.eduweb.vic.gov.au/edulibrary/public/teachlearn/teacher/ProfLearningInEffectiveSchools.pdf) (<http://www.eduweb.vic.gov.au/edulibrary/public/teachlearn/teacher/ProfLearningInEffectiveSchools.pdf>)
- [Principles of Learning and Teaching](http://www.education.vic.gov.au/studentlearning/teachingprinciples/principles/principlesandcomponents.htm) (<http://www.education.vic.gov.au/studentlearning/teachingprinciples/principles/principlesandcomponents.htm>)

## Icons

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The following icons have been used in this workshop program:

**Distribute handout:** 

**Group discussion:** 

# User's Guide to Module 1: Overview of Learning in the Mathematics Domain

Slide 1 is the title slide

## Outline

Slide 2 provides an outline of module 1– Overview of learning in the Mathematics Domain.

This module includes the following:

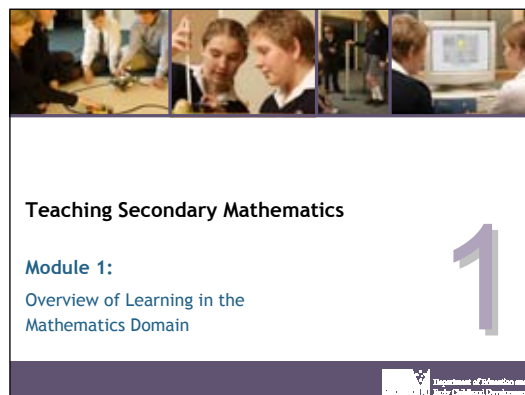
1. Teaching Secondary Mathematics modules
2. Main themes of the Resource
3. The Learner at the Centre
4. Mathematics as a Domain in the VELs
5. Mathematics and PoLT P-12
6. International student achievement data
7. Overarching themes of this resource
8. Online resources

## 'Teaching Secondary Mathematics' modules

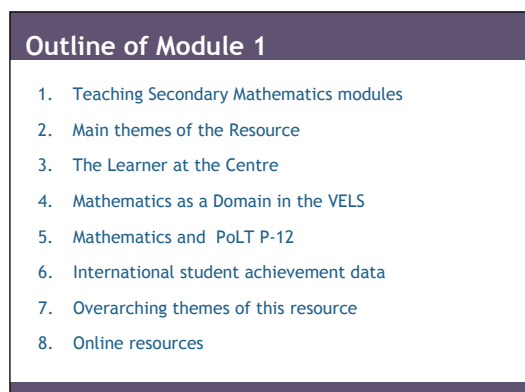
Slide 3 provides an outline of the nine modules contained within this resource. The slide provides the pedagogical and mathematical theme for each module.

Facilitators may wish to focus on a theme of particular need or interest as each module may be presented separately.

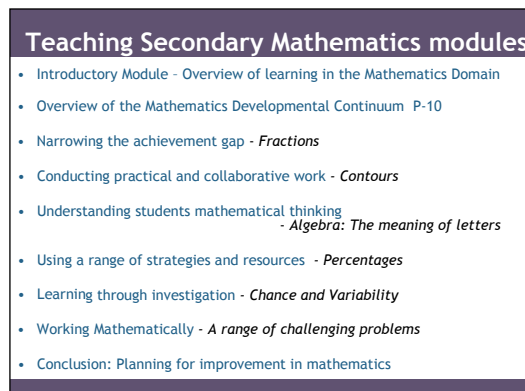
- Module 1 – Introductory Module: Overview of learning in the Mathematics Domain
- Module 2 – Overview of the Mathematics Developmental Continuum P–10
- Module 3 – Narrowing the achievement gap: Fractions
- Module 4 – Conducting practical and collaborative work: Contours
- Module 5 – Understanding students mathematical thinking: Algebra- the meaning of letters
- Module 6 – Using a range of strategies and resources: Percentages
- Module 7 – Learning through investigation: Chance and variability
- Module 8 – Working mathematically: A range of challenging problems
- Module 9 – Conclusion: Planning for improvement in mathematics



Slide 1: Title slide



Slide 2: Outline of Module 1



Slide 3: Teaching Secondary Mathematics modules

## Main themes of this resource

1. An emphasis on teaching that places 'the learner at the centre'
2. The use of school-based data and formative assessment to plan instruction that meets the learning needs of individual students
3. An opportunity for teachers to familiarise themselves with resources from the [Student Learning](#) website.
4. An opportunity to examine the more broad goals of Mathematics teaching in terms of the [Principles of Learning and Teaching P-12, Assessment](#) and the [Victorian Essential Learning Standards](#)
5. Provide insights into the mathematical thinking of Years 7-10 students

### Slide 4: Main themes of this resource

## The Learner at the Centre

Student Learning initiatives support teachers in:

- Understanding the needs of each student through [assessment](#)
- Planning targeted, purposeful teaching
- Knowing what is powerful to learn ([VELS](#))
- Knowing what promotes powerful learning ([PoLT](#))



### Slide 5: The Learner at the Centre

## Main themes of the 'Teaching Secondary Mathematics' resource

Slide 4 describes the main themes of the Teaching Secondary Mathematics resource.

These are:

- An emphasis on teaching that places the learner at the centre.
- The use of school-based data and formative assessment to plan instruction that meets the learning needs of individual students.
- An opportunity for teachers to familiarise themselves with resources from the Student Learning website.
- An opportunity to examine the broader goals of mathematics teaching in terms of the Principles of Learning and Teaching P-12 (PoLT), Assessment and the Victorian Essential Learning Standards (VELS).
- An opportunity to gain insights into the mathematical thinking of Years 7-10 students.

## The Learner at the Centre

Slide 5 describes the learner at the centre principle. The Teaching Secondary Mathematics resource supports the Department of Education and Early Childhood Department (DEECD) initiatives through placing the learner at the centre. Teachers must first identify what students know and understand the mathematics so that they can plan the most effective teaching and learning strategy. These strategies will build on the students' prior knowledge, skills and behaviours and support all students to develop new knowledge and skills. Furthermore, The Victorian Essential Learning Standards (VELS) and Principles of Learning and Teaching P-12 (PoLT) support the effective teaching of mathematics.

All teachers play a role in fostering students' mathematics achievement and in making the connections between knowledge and application. Liaison between mathematics teachers and other school staff is necessary in order to encourage the complementary learning that can occur within other domains. While teachers of mathematics have the primary responsibility to develop student mathematical understandings, there are mathematical demands within other learning domains such as Science and Geography. Aspects of mathematics learning within other domains include using a scale on a map, critically analysing data and text containing quantitative information and reading measurements for experiments or interpreting graphs.

The Department's Student Learning resources are designed to assist teachers in understanding and addressing the individual learning needs of their students. For example, the Mathematics Developmental Continuum P-10 will be most effective when it is used to identify and plan for personalised student learning and to support purposeful teaching for individuals and small groups of students with similar learning needs.

See:

- [Student Learning](http://www.education.vic.gov.au/studentlearning/default.htm) (<http://www.education.vic.gov.au/studentlearning/default.htm>)
- [Mathematics Developmental Continuum P–10](http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/default.htm) (<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/default.htm>)

## Additional notes

### Victorian Essential Learning Standards (VELS)

The Victorian Essential Learning Standards (VELS) describe what is essential for all students to achieve from Years Prep to 10 in Victorian schools. The Mathematics Domain in VELS supports the development of Number, Space, Measurement, Chance and Data, Structure and Working Mathematically knowledge for all students.

#### Assessment

Assessment is the ongoing process of gathering, analysing and reflecting on evidence to make informed and consistent judgements to improve future student learning. Its purpose is to improve student learning and deep understanding requires a range of assessment practices to be used with three overarching purposes:

- Assessment FOR learning – occurs when teachers use inferences about student progress to inform their teaching.
- Assessment AS learning – occurs when students reflect on and monitor their progress to inform their future learning goals.
- Assessment OF learning – occurs when teachers use evidence of student learning to make judgements on student achievement against goals and standards.

### Principles of Learning and Teaching (PoLT) P–12

Throughout the modules mathematical topics have been selected as vehicles for discussing teaching issues. Additional examples of teaching strategies are included in the Principles of Learning and Teaching (PoLT) P–12 Online Professional Learning Resource. This resource includes a number of classroom activity snapshots (vignettes) which focus on particular stages of learning and explore the principles in action within a mathematics classroom.

The two examples noted below reflect PoLT Principle 4: Students are challenged and supported to develop deep levels of thinking and application.

- [Level 5 Mathematics – A Grain of Rice](http://www.education.vic.gov.au/studentlearning/teachingprinciples/onlineresource/p4/vig_MY.htm#9) ([http://www.education.vic.gov.au/studentlearning/teachingprinciples/onlineresource/p4/vig\\_MY.htm#9](http://www.education.vic.gov.au/studentlearning/teachingprinciples/onlineresource/p4/vig_MY.htm#9))
- [Level 5 Mathematics – Are they Thinking What I Am Thinking?](http://www.education.vic.gov.au/studentlearning/teachingprinciples/onlineresource/p4/vig_MY.htm#10) ([http://www.education.vic.gov.au/studentlearning/teachingprinciples/onlineresource/p4/vig\\_MY.htm#10](http://www.education.vic.gov.au/studentlearning/teachingprinciples/onlineresource/p4/vig_MY.htm#10))

## Scaffolding Learning



Slide 6: Scaffolding Learning

## Scaffolding Learning – Vygotsky

Russian psychologist Lev Vygotsky has made major contributions to our understanding of student learning. Vygotsky's work was not well known in the west until it was taken up by other psychologists and translated into English. It has had a significant influence on education and has led to the development of two key concepts for learning and teaching: the Zone of Proximal Development and Scaffolding.

Vygotsky was particularly interested in the ways children were challenged and extended in their learning by adults. He argued that the most successful learning occurs when children are guided by adults towards learning things that they could not attempt on their own.

Vygotsky coined the term 'Zone of Proximal Development' to refer to the zone where teachers and students work as children move towards independence. This zone changes as teachers and students move past their present level of development towards new areas of knowledge.

## Split screen thinking

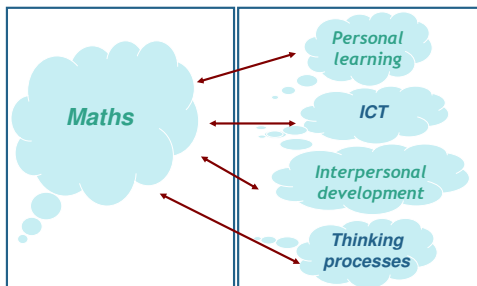
Slide 7 illustrates the concept of split screen thinking. Split screen thinking provides a link between the Mathematics Domain and other domains in the VELs. An explanation of split screen thinking is demonstrated in this slide. Guy Claxton (2006: p11) writes of learning dispositions and developing students' capacity to learn.

'On one "screen" inside their heads teachers are thinking about how to help students grasp the content. On the other screen, at the same time, they are thinking about how to help students develop their learning capacity.'

The Teaching Secondary Mathematics resource focuses on the Mathematics Domain in the Discipline-based Learning strand. In teaching mathematics, standards from other domains can be achieved and recorded. Through students studying real world mathematics they may also refer to other domains (such as Science and Geography).

In addition, this resource connects with the Thinking Processes and ICT domains in the Interdisciplinary Learning strand and Personal Learning from the Physical, Personal and Social Learning strand.

## Split Screen Thinking



Slide 7: Split screen thinking

## Mathematics as a Domain in the VELs

Group discussion



1. Select one of the following Domains:
  - [Thinking Processes](#)
  - [Interpersonal Development](#)
  - [Personal Learning](#)
2. Discuss with your group:
  - One way in which Mathematics can make a strong *contribution* to this Domain
  - One aspect of this Domain which is especially *challenging* when teaching Mathematics

Slide 8: Mathematics Domain as a domain in the VELs


## Mathematics in the VELs

Slide 8 prompts participants to discuss the links between the Mathematics Domain and other domains in VELs.

Students' learning in mathematics contributes to their learning in other domains including Thinking Processes, ICT, Personal Learning and Interpersonal Development.

- **Thinking Processes:** inquiry, processing information, reasoning, problem solving, evaluation and reflection.
- **Interpersonal Development:** learning to work with others.
- **Personal Learning:** acquire self knowledge and dispositions that support learning; take greater responsibility for own learning.

All of these processes are relevant to the teaching of mathematics. This interaction is two-way; for instance, students' thinking and capacity to learn improves their mathematics learning as mathematics thinking improves their thinking processes.

 In this discussion, it may be useful for teachers to access the particular VELS domain they have chosen to discuss – either a hard copy or electronic access should be made available.

 **Use slide 7– Mathematics in the VELS**

#### Invite participants to:

1. Select one of the following VELS domains:
  - **Thinking Processes** (<http://www.education.vic.gov.au/studentlearning/teachingresources/thinkingprocesses/default.htm>)
  - **Interpersonal Development** (<http://www.education.vic.gov.au/studentlearning/teachingresources/interpersonaldevelop/default.htm>)
  - **Personal Learning** (<http://www.education.vic.gov.au/studentlearning/teachingresources/personallearning/default.htm>).
2. Discuss with their group:
  - one way in which mathematics can make a strong contribution to their chosen domain
  - one aspect of this domain which is especially challenging when teaching mathematics.

Some possible challenges which may be raised by participants include:

- Some students do not want to engage in difficult thinking.
- There is a large range of abilities in any mathematics classroom.
- Teachers should try and make mathematics relevant to students' interests and learning.

## The Principles of Learning and Teaching P–12

 **Provide participants with a copy of:**

- **Principles of Learning and Teaching P–10 and their components** (<http://www.education.vic.gov.au/studentlearning/teachingprinciples/principles/principlesandcomponents.htm>)

This is also available as Resource 1.

Slide 9 provides the questions which will provoke the group discussion. These questions are designed to raise participants' awareness of the links between teaching mathematics and the Principles of Learning and Teaching.

The PoLT highlights ways that teachers can ensure students' experiences of mathematics are engaging and relevant to their needs.

The resultant pedagogy used by teachers would make learning mathematics a more satisfying experience for students and would contribute to the growth of the whole person.

#### Principles of Learning and Teaching P-12 and Mathematics

##### Group discussion:

Select one of the 6 principles from PoLT P-12 and

- Identify one way in which this principle is easy to implement in Mathematics classes.
- Identify one way in which this principle is challenging to implement in Mathematics classes.

*NB: Try to identify issues specifically related to teaching and learning Mathematics.*

#### Slide 9: Principles of Learning and Teaching P–12





The studies confirm that variation from predicted score is due to the teaching and learning that happens at school. This resource will help mathematics teachers identify and address issues that confront them in their practice.

Victorian government schools are now able to link together Student Family Occupation (SFO) with other school data, such as AIM data. This will allow schools to assess and compare their relative progress against other 'like' schools taking into student background factors.

## Student achievement

Slide 11 challenges participants to draw some inferences from this data. You may also wish to refer to the explanation of school SFO data:

- [School Performance Data – Percentile/SFO Comparison Charts](http://www.education.vic.gov.au/management/schoolimprovement/performancecharts/charts.htm) (<http://www.education.vic.gov.au/management/schoolimprovement/performancecharts/charts.htm>)

 Use slide 11– International student achievement data

**Invite participants to discuss the following question:**

From your experience, what are the factors that make a class in a school achieve considerably better in mathematics factors (such as socio-economic status, encouragement, motivation and support from home)?

**The main point is to recognise that teachers make the greatest difference to student achievement. Research by John Hattie (2003) supports this conclusion.**

## Useful resources located on the Mathematics Domain page

The online resources hyperlinked on slide 12 will be featured in the Teaching Secondary Mathematics modules.

- [Mathematics Developmental Continuum P–10](http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/default.htm) provides evidence-based indicators of progress, linked to powerful teaching strategies, aligned to the progression points and the standards for the Mathematics Domain of the Victorian Essential Learning Standards. Indicators of progress are points on the learning continuum that highlight critical understandings required by students in order to progress through the standards. (<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/default.htm>)
- [Scaffolding Numeracy in the Middle Years \(5–9\)](http://www.education.vic.gov.au/studentlearning/teachingresources/maths/snmy/default.htm) is an assessment-guided approach to improving student numeracy outcomes in the middle years. The suite of resources brings together, in a hierarchy, the key ideas, strategies and representations of multiplicative thinking needed to work flexibly and confidently with whole numbers, fractions, decimals, and percentages across a wide range of contexts. (<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/snmy/default.htm>)

### International student achievement data

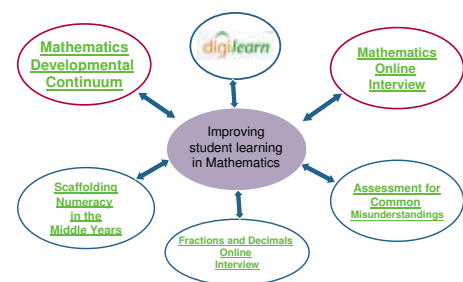
Group Discussion:



From your experience, what are the factors that make a class in a school achieve considerably better in Mathematics than would be predicted by [home background](#) factors (such as socio-economic status, encouragement, motivation and support from home)?

Slide 11: International student achievement data

### Online resources



Slide 12: Online resources

- Digilearn is the DEECD portal for accessing exciting digital learning resources for use in the classroom. These resources include The Learning Federation learning objects and digital resources. Access is available from within your school and outside of school if you login with your pin number and your edumail password.  
(<http://www.education.vic.gov.au/studentlearning/teachingresources/elearning/digilearn.htm>)
- Assessment for Common Misunderstandings (P–10) provides assessment tools that expose students' thinking. It also requires an interpretation of what different student responses might mean and some practical ideas to address the particular learning needs identified. This is particularly important in relation to a relatively small number of 'big' ideas and strategies in Number, without which students' progress in mathematics will be seriously impacted.  
(<http://www.education.vic.gov.au/studentlearning/teachingresources/elearning/digilearn.htm>)
- Fractions and Decimals Online Interview is a diagnostic tool which will allow teachers to better understand their students' knowledge, skills and behaviours with regard to fractions and decimals, a known 'hot spot' of difficulty for many students. It will allow comprehensive collated data to be available that can be compared within schools to better understand student achievement and monitor student progress.  
(<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/assessment.htm>)
- Mathematics Online Interview is a diagnostic tool that is used to gather information on the most sophisticated strategies that students use during their mathematical thinking – not just for students to gain the correct answers. Data from the Mathematics Online Interview enables detailed individual and group or class profiles to be developed automatically, tracking progress through the stages of mathematical growth. Questions from the interview have now been linked to the Victorian Essential Learning Standards and progression points from Level 1 - Level 4, but could be used at the lower end of secondary school where many students are still working at Level 4.  
(<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/assessment.htm>)
- Algebra and Fractions (Effective Mathematics Teaching DVD) was sent to all schools during term 3, 2007. This DVD includes a variety of video clips from the classrooms of Victorian teachers. The material is intended to provide the basis of professional conversations amongst teachers regarding effective teaching practices.  
(<http://www.education.vic.gov.au/studentlearning/teachingresources/maths/effectivemathdvd.htm>)

## Overarching themes

Slide 13 revisits the overarching themes of this resource.

To improve mathematics learning in schools we need to work on the following:

### 1. Student achievement

As highlighted by previous international and national data, there is considerable scope for raising the attainment of high-achieving students and providing support to improve the performance of under-achieving students.

### 2. Making learning mathematics a more satisfying experience for students.

Students' classroom experiences should enable them to find learning mathematics an empowering experience with positive affect. This is not just 'fun' and 'enjoyment' but also feelings of satisfaction, being valued as a person and getting rewards for making significant efforts.

### 3. Mathematics (and other subjects) should offer students experiences which increase their learning capacity.

In turn, students with increased learning capacity will do better in mathematics. Capacity to learn is developed through working independently, working in teams and using a range of thinking processes including metacognitive processes.

### 4. Making sure that mathematics contributes to the growth of the whole person.

All teaching and learning at school needs to contribute to a student's growth as a community member. For mathematics this is in two ways: as a citizen with sufficient numeracy skills to live a fulfilling life and contribute to the community; and also as a classroom member who interacts well with others, and assists in making school life productive.

Every student is able to learn mathematics. All students need to be challenged with mathematics that extends their current understanding, promoting an inclusive culture in mathematics.

## Conclusion

Slide 14 is the concluding slide.

There are 8 more professional learning modules:

2. Overview of the Mathematics Developmental Continuum P–10
3. Narrowing the achievement gap: Focus on fractions
4. Conducting practical and collaborative work: Focus on contours
5. Understanding students' mathematical thinking: Focus on algebra and the meaning of letters
6. Using a range of strategies and resources: Focus on percentages
7. Learning through investigation: Focus on chance and variability
8. Working mathematically: Focus on a range of challenging problems
9. Conclusion: Planning for improvement in mathematics

### Overarching themes

To improve mathematics learning in schools, we need to work on making a difference to each student's:

- **Achievement** in maths
- **Experiences** of learning Mathematics
- **Capacity** as a learner
- **Growth** as a community member

#### Slide 13: Overarching themes

### End of Module 1

- This is the last slide of the module
- Further questions...
- [studentlearning@edumail.vic.gov.au](mailto:studentlearning@edumail.vic.gov.au)
- Subject field- Teaching Secondary Mathematics

#### Slide 14: End of Module 1

# Resource 1: Principles of Learning and Teaching P–12 and their components

[Principles of Learning and Teaching P–12 and their components](http://www.education.vic.gov.au/studentlearning/teachingprinciples/principles/principlesandcomponents.htm) (<http://www.education.vic.gov.au/studentlearning/teachingprinciples/principles/principlesandcomponents.htm>)

## **Students learn best when:**

**The learning environment is supportive and productive.** In learning environments that reflect this principle the teacher:

- 1.1) builds positive relationships through knowing and valuing each student
- 1.2) promotes a culture of value and respect for individuals and their communities
- 1.3) uses strategies that promote students' self-confidence and willingness to take risks with their learning
- 1.4) ensures each student experiences success through structured support, the valuing of effort, and recognition of their work.

**The learning environment promotes independence, interdependence and self motivation.** In learning environments that reflect this principle the teacher:

- 2.1) encourages and supports students to take responsibility for their learning
- 2.2) uses strategies that build skills of productive collaboration.

**Students' needs, backgrounds, perspectives and interests are reflected in the learning program.** In learning environments that reflect this principle the teacher:

- 3.1) uses strategies that are flexible and responsive to the values, needs and interests of individual students
- 3.2) uses a range of strategies that support the different ways of thinking and learning
- 3.3) builds on students' prior experiences, knowledge and skills
- 3.4) capitalises on students' experience of a technology rich world.

**Students are challenged and supported to develop deep levels of thinking and application.** In learning environments that reflect this principle the teacher:

- 4.1) plans sequences to promote sustained learning that builds over time and emphasises connections between ideas
- 4.2) promotes substantive discussion of ideas
- 4.3) emphasises the quality of learning with high expectations of achievement
- 4.4) uses strategies that challenge and support students to question and reflect
- 4.5) uses strategies to develop investigating and problem solving skills
- 4.6) uses strategies to foster imagination and creativity.

**Assessment practices are an integral part of teaching and learning.** In learning environments that reflect this principle the teacher:

- 5.1) designs assessment practices that reflect the full range of learning program objectives
- 5.2) ensures that students receive frequent constructive feedback that supports further learning
- 5.3) makes assessment criteria explicit
- 5.4) uses assessment practices that encourage reflection and self assessment
- 5.5) uses evidence from assessment to inform planning and teaching.

**Learning connects strongly with communities and practice beyond the classroom.** In learning environments that reflect this principle the teacher:

- 6.1) supports students to engage with contemporary knowledge and practice
- 6.2) plans for students to interact with local and broader communities and community practices
- 6.3) uses technologies in ways that reflect professional and community practices.

## References

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