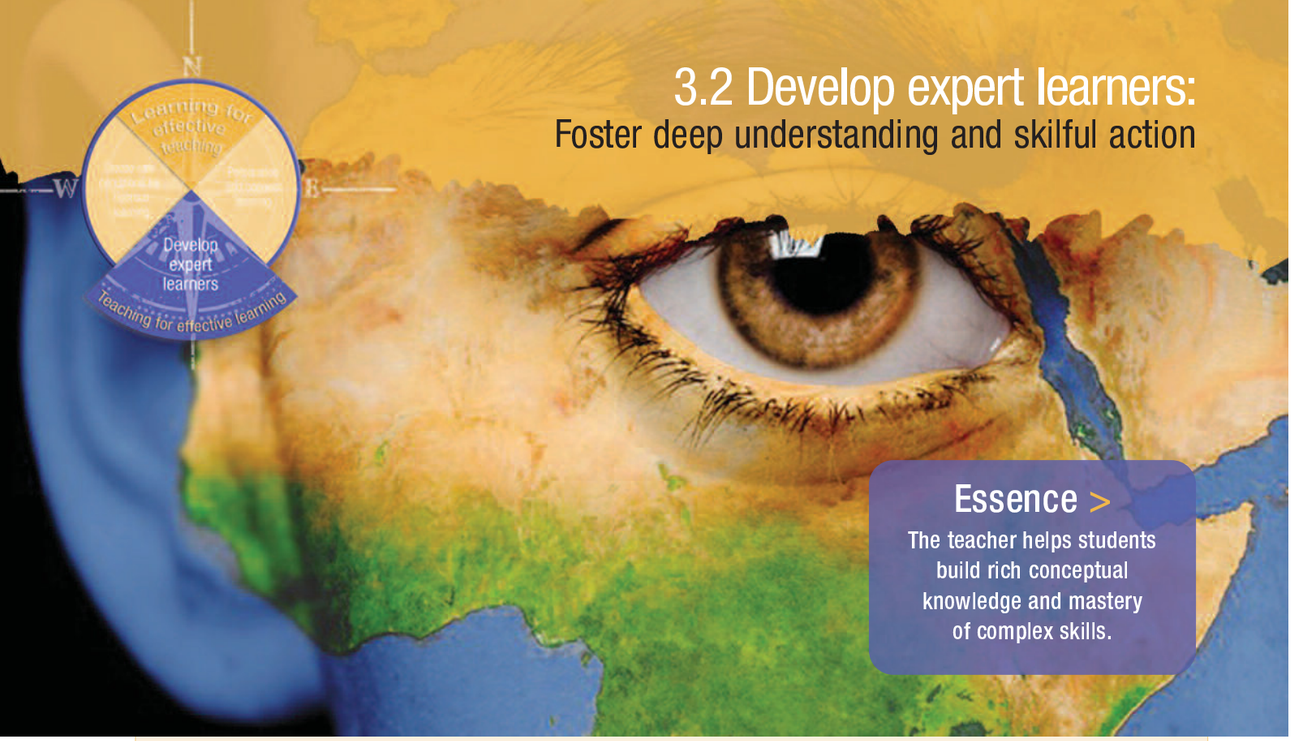

3.2 Develop expert learners:
Foster deep understanding and skilful action

Essence >
The teacher helps students build rich conceptual knowledge and mastery of complex skills.

Earthquakes shake up a classroom

We had the Smartboard ready and the students were keen to explore our new Geographic Information System (GIS). They could add data to maps to change visual representations and investigate issues.

I used their latest interest. 'Look at the screensaver earthquake pictures. We must have some experts in our midst. Does every place in the world have earthquakes?' I asked.

This very first question had the students responding. They were diligent, curious and exuberant, all at the same time. I fed their momentum by thinking aloud: 'I wonder why some areas have more earthquakes than others?'. There were plenty of experts eager to share their knowledge in response.

'There are these tectonic plates,' said one student. 'I think they've got something to do with it.'

It was time for the interactive searches. We added 'tectonic plates' to our map and predicted where earthquakes might happen. The students came to the screen and pointed to particular parts of the map. Some added extra pieces of information that they thought might be useful to our quest.

We added the 'earthquake' data. Our predictions were very close. That was great feedback! Then the excitement changed to puzzlement. Suddenly, the students saw one area with a huge number of earthquakes, and they were worried. There was real concern that it wouldn't be safe to live there or even visit there. Discussion was intense. I posed the question, 'Do you think that all of the earthquakes happen at the same time?'.

Now the students were weighing up visual data with personal reasoning. They were seeing the whole concept growing by the minute. Their minds were in overload, yet turbo-charged. They didn't look like giving up.

I posed more questions: 'Would all earthquakes be the same size? How do they measure how big an earthquake is?'.

It was back to the students. One told us about seismographs. He'd seen one at the science centre; he drew a zigzagging earthquake graph on the board. I showed the class how to organise the data to see when earthquakes occurred and how big they might be.

The students devoured the avalanche of data. Their enthusiasm showed in the self-questioning, the sharing of knowledge and the new learning. They were pushing themselves. The GIS data and instant feedback had resulted in deep learning, building on what they knew and wanted to know, generating questions, predictions, explorations and hypotheses, and enabling the students to use data to inform their next steps.

The use of raw data led the students to identify patterns and it supported and demanded scientific thinking. Students were pushed into complex thinking and new understandings that could be harnessed next time we used data.

There was a time that I would have just told them the 'answer'. But I've learnt the power of tapping into their questions and how 'interest' takes them deeper and deeper into the learning.

Primary teacher

Key actions: Teachers

- Develop my own deep understanding of the concepts I teach
- Design activities that lead students to grasp concepts and deepen their understanding
- Devote time and effort to helping my students grapple with the concepts, and get them to explain concepts to each other to ensure deep understanding
- Pose open questions with no right or wrong answers, to evoke students' emotions, imagination, reflection, action and research from a range of sources and perspectives
- Teach students explicit strategies for higher order thinking, and structure tasks where they choose strategies to investigate issues, develop their understanding, refine their skills and communicate what they've learnt
- Encourage self-testing
- Ask students to determine what level of practice they need to develop mastery and automaticity
- Model self-reflection, critical thinking, creative imagination and questioning of my own assumptions
- Guide students in searching for patterns and relationships to interpret information and experience
- Emphasise the power of precision in language
- Incorporate reflection and targeted formative assessment to ensure rigorous learning
- Use strategies to help learners connect new knowledge to their own prior experience, other disciplines and the world beyond the classroom
- Value students' input and commit quality time for them to discuss, share knowledge, explain their thinking, question assumptions and refine their understanding
- Guide and support learners to achieve a level of mastery that enables them to experience empowerment and intrinsic satisfaction
- Use models and illustrative stories to engage the imagination of students
- Engage students in working with authentic problems and issues

Key actions: Students

- Use thinking strategies that I've been taught, to help me understand better
- Talk about learning with others, share feedback, explain things and help solve problems
- Work together to fire questions and challenge our thinking, without being right or wrong
- Make the most of all the technologies I can use for learning
- Ask myself: 'Where am I heading?', 'What else might I need to know?', and 'How could I do it in another way?'
- Never give up, be proud of my efforts, and know for myself when I've really 'got it'
- Ask questions when I don't understand
- Seek feedback on how I could improve my skills
- Ask myself: 'Do I need to practise this more to feel really sure I can do it?'

The role of the educator is not to put knowledge where knowledge does not exist but rather to lead the mind's eye that it might see for itself.
Plato

Justice alert

Have I made sure *every student* has developed the important understandings and mastery of the skills?

Ways to foster deep understanding and skilful action

Use learning and teaching models: Use learning and teaching models to design learning for deep understanding and skilful action (eg Integral Learning Model, 5Es, Format, ESL Teaching Cycle).

Develop higher order thinking skills: Explicitly coach students in the use of question frameworks such as Bloom's Taxonomy, Question Matrix, 3 Storey Intellect, and SOLO. Record students' questions and teach them how to identify links.

Question wall: Students display questions that they think might be answered during a topic. Discuss the types with students—open, closed, speculative, divergent, clarifying, essential—and how they will need different strategies and lead to different reactions/forms of information. Draw up lists of generic questions to use for certain types of tasks (eg scientific investigation). Refer to and extend these question groups regularly.

Use precise language: Model and teach the language constructs for specific disciplines of learning, so that students are skilled in using language most appropriate for specific tasks (eg a film review needs different language from a data analysis report).

Exposition writing: Students use exposition writing to analyse differing perspectives and extract their own deep meaning.

Mu dictionary: Using this technique, students can express meaning in four different 'ways of knowing':
Propositional—'How can I describe/define this?'
Factual—'Some examples are …'
Personal—'What's this got to do with my life?'
Conceptual—'Can I express this as an image or illustration?'

Deepest understanding emerges from the integration of these four 'ways of knowing'.

The teacher can develop a mu dictionary of definitions of concepts to clarify what he/she wants the students to know and be able to do.

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Learning logs/reflective journals: By documenting their progress, students can stop and think about what they are learning and how they are developing it within the 'big picture'.

Learning log
Try these for sentence starters
1 I now feel confident about … 2 I felt confused when … 3 What I would most like to know is … 4 I'm having problems with …

Reflective journal	
What happened?	
How do I feel about it?	
What did I learn?	

Strengthen connections in the brain: Use practice, repetition and instructional supports such as demonstration, video clips and pre and post quizzes for skill mastery. Use processes like think–pair–share and graphic organisers for students to sort knowledge, represent their thinking visually and clarify meaning.

Mind space: The mind sifts information with time. Use drawing, music, colour and silence to create space for reflection. Give students time for wandering in their minds to access their imagination, memories and images.

Goal setting: Ask students to set specific individual goals for master. Help them develop habits of goal setting and self-assessment.

Concept attainment: Use these steps to encourage concept attainment:

- Select a concept with clear critical attributes (eg evergreen plants, carnivores, mammals, fish).
- Provide students with 'yes' examples which fit the concept and some 'no' examples that have some of the attributes needed but not all.
- Ask students to hypothesise about what the 'yes' examples have in common.
- Provide more 'yes' and 'no' examples for students to test and refine their original thinking.
- As a whole group, make a list of critical/necessary attributes.

Students apply their knowledge of the concept in multiple contexts to demonstrate understanding.

Language that teachers can use to foster deep understanding and skilful action

- What are you wondering? Why? What if …?
- What is the meaning of …? How does it connect to what you already know?
- If you really believe that … then how will it shape your thinking from here?
- Each of you has your own way of seeing it, so let's explore all the perspectives.
- Can you clarify your point of view? Can you justify your conclusions?
- Try brainstorming lots of possible questions on the issue.
- Which thinking strategies would work best?
- Looking at the information, can you see common elements emerging?
- Could you represent this concept in another way—visual, musical, mathematical, technological, movement?
- How are you feeling? Are you getting closer to really understanding?
- How has this learning changed how you see things?
- What goals do you have for your learning in this activity?

The basic goal of education is understanding. You have to take enough time to get kids deeply involved in something they can think about in lots of different ways.

Howard Gardner

This element is not demonstrated if:

- Teachers focus on 'covering' rather than 'discovery', 'telling' rather than 'asking'
- Lessons are presented in isolation rather than linked in sequence within the 'big picture'
- Students are presented with topics to learn about, but few important issues to explore or research
- Priority is given to mastering recall of facts only
- Short timelines restrict students' opportunities for meaningful interaction and critical feedback
- A student is always expected to publicise her/his achievements
- Learners' questions are dismissed or seen as irrelevant
- Time and opportunities are not provided for individuals to develop mastery of skills

Practice check

- Do I develop a deep understanding myself in order to guide students to their deep understanding?
- Am I walking the talk by analysing my own thinking?
- What big ideas/concepts do I believe my students need to understand in relation to the Curriculum Standards?
- How will I scaffold students' ongoing efforts in learning?
- Does the class culture support each student to persevere towards deeper understanding?
- Do I value student inquiry and adapt my teaching to respond to individual questions at pivotal stages?
- Am I connecting with each student to assess mastery of complex skills?

Notes:

Knowledge construction is best accomplished through collaboration. There is a good deal of evidence that learning is enhanced when teachers pay attention to the knowledge as a starting point for new instruction and monitor students' changing conceptions as instruction proceeds.

John Bransford, Ann Brown & Rodney Cocking

get below the surface