CURIOSITY AND
POWERFUL LEARNING

CURIOUSER AND CURIOUSER

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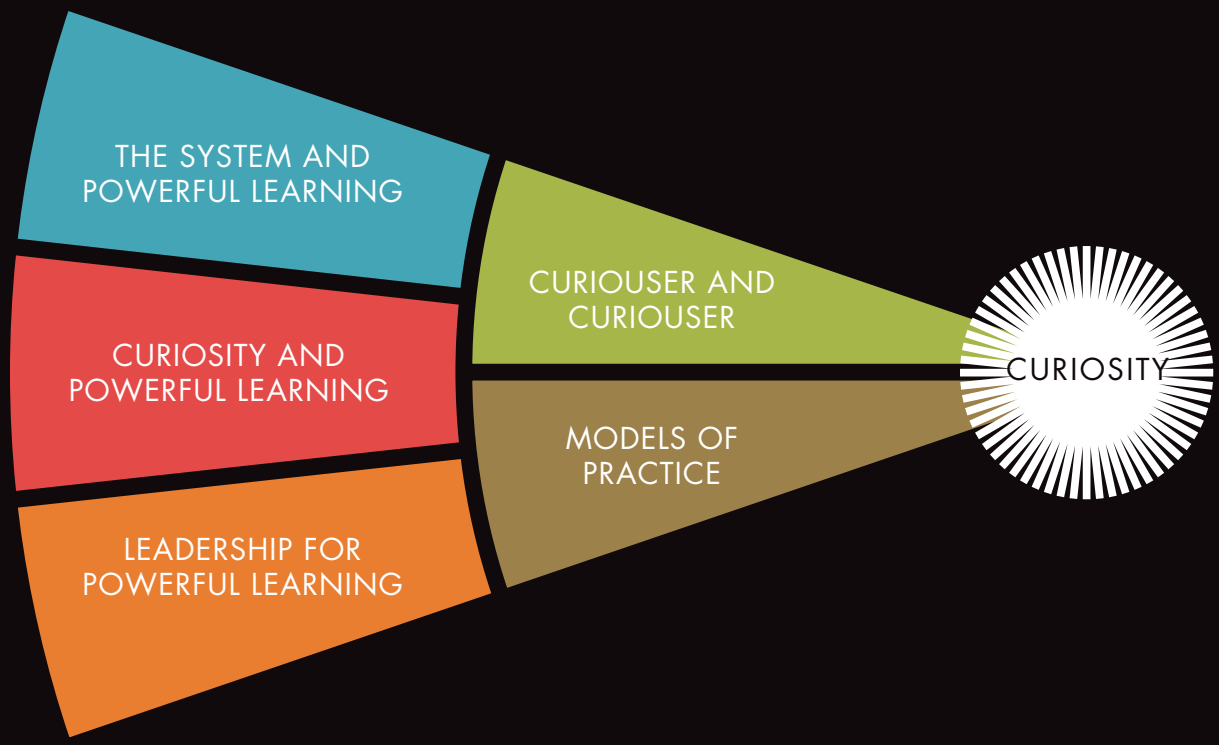
THE CURIOSITY AND POWERFUL LEARNING SERIES

The Curiosity and Powerful Learning manuals are designed for teachers and for school and system leaders who are embarked on a school improvement journey. The manuals describe how schools can lift student learning. The steps are drawn from practical experience, tested and refined in schools over time.

Three manuals are at the core of the series – *The System and Powerful Learning*, *Curiosity and Powerful Learning*, and *Leadership for Powerful Learning*. Together they explain how powerful learning is made real for our students through purposeful, specific changes in whole school culture, classroom culture, leadership, and teaching practice.

The series includes *Curiouser and Curiouser* and *Models of Practice* manuals which concentrate on precision in teaching practice. They stand as references for improving, planning, and monitoring professional practice, assisting us to get to the heart of the learning enterprise.

The manuals recognise that schools differ, and must differ in responding to their communities. Diversity among schools is cause for celebration, as is consistently high student learning outcomes in all schools. Each manual emphasises the collective endeavour essential to achieving curiosity driven powerful learning. Teachers work together, students become more adept at using curiosity as a learning resource, leaders communicate purpose and direction. We all monitor outcomes and adapt as we go. We are all professional learners.



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CURIOUSER AND CURIOUSER – ENRICHING LEARNING

Curiosity is the engine that drives learning. *Curiouser and Curiouser* maps curiosity into student learning actions. The manual identifies teaching actions that optimise learning actions.

We use the word 'curiosity' in many and varied ways in day to day conversation. Often we use it vaguely. But if we are to harness the power of curiosity as a learning resource then we need to understand how it works with precision, and know how to nurture it in specific ways. *Curiouser and Curiouser* does just that – it's work is to assist teachers to 'see curiosity' in learning and teaching activity.

CURIOSITY THINKING

Curiosity motivates learning. Exploratory curiosity, as we explain on page 4, emerges when we mix the attraction of novel stimuli with taking risks. Intellectual curiosity is characterised by the desire to learn new ideas, to discover more about something that interests you. This manual investigates both these types of curiosity and how to establish links between them.

Our students tap their capacity for curiosity as a resource for exploring and understanding their lives. Curiosity is innate. It is also an attribute that can be cultivated – our students can learn how to use curiosity strategically. The challenge is to support our students to learn how 'curiosity thinking' works and how to deploy it effectively.

Learning curiosity thinking relies on a positive school learning culture and a supportive classroom climate. *Curiosity and Powerful Learning*, one of the manuals in the Powerful Learning series, proposes ten Theories of Action that schools can enact to produce the culture and climate in which curiosity thrives. In an environment that puts the Theories of Action to work, curiosity thinking will be valued, modeled, scaffolded, and automatised in every classroom in the school.

THE CURIOSITY TOOBOX

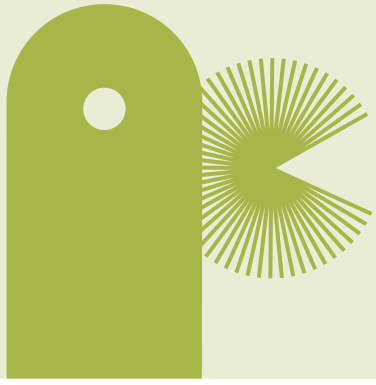
Curiosity is unlimited. *Curiouser and Curiouser* offers teaching tools for cultivating curiosity as a lifelong learning resource. Those tools are forged from evidence in psychological-cognitive, educational, and brain research about how to foster and develop curiosity.

Our emphasis is on explicitly teaching ways of thinking that draw on our students' predisposition to curiosity. Implications for teaching practice are investigated for each of the questions about curiosity that we ask teachers to consider. The manual offers guidance about how to manage these implications though focused and directed teaching which thoughtfully scaffolds and guides student activity so that it is propelled by curiosity thinking.

Every one of our students can learn curiosity thinking skills that will benefit their academic learning. They will invest effort into learning curiosity thinking skills if they know those skills are valued, and if they have personal evidence that curiosity thinking works for them.

We can demonstrate the value we put on curiosity thinking through our teaching practice. And our teaching practice will generate for each of our students the evidence that curiosity thinking is an intriguing toolbox that opens numberless doors to powerful learning.

'Why,' said the Dodo, 'the best way to explain it is to do it.'



WHAT'S IN THIS MANUAL?

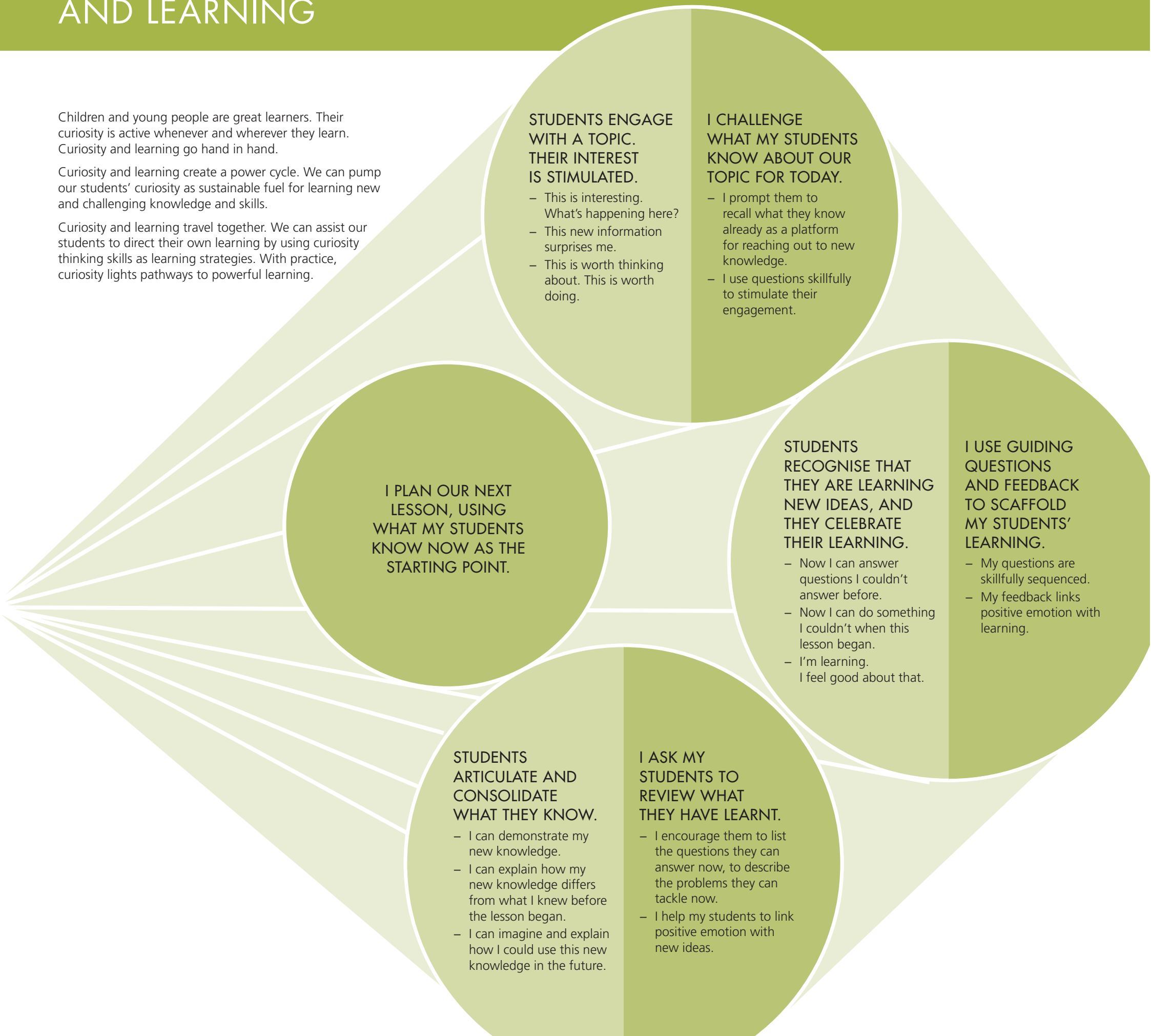
Our focus is on students learning to be curious in classrooms. Implications for teaching appear throughout the manual.

CURIOSITY AND LEARNING

Children and young people are great learners. Their curiosity is active whenever and wherever they learn. Curiosity and learning go hand in hand.

Curiosity and learning create a power cycle. We can pump our students' curiosity as sustainable fuel for learning new and challenging knowledge and skills.

Curiosity and learning travel together. We can assist our students to direct their own learning by using curiosity thinking skills as learning strategies. With practice, curiosity lights pathways to powerful learning.



QUESTION 1

WHAT IS CURIOSITY MADE OF?

(IM) (PE) (PK) Look for these symbols in the remainder of the manual. The symbols indicate how ideas and practices covered in the manual relate to the three important elements of **Positive Emotion**, **Intrinsic Motivation**, and **Pursuit of Knowledge**.

DEFINING CURIOSITY FOR THE CLASSROOM

Curiosity fuses three elements that support powerful learning:

(PE) POSITIVE EMOTION

Curiosity stimulates our students to respond to unfamiliar or challenging information.

(IM) INTRINSIC MOTIVATION

Curiosity drives the impulse to learn. It leads our students to operate as self-directing, autonomous learners who shape and self-regulate their learning activities.

(PK) PURSUIT OF KNOWLEDGE

Curiosity gives learning and thinking a focus or direction.

Our task is to create opportunities for our students to link positive emotion and intrinsic motivation with how they interpret new information and develop new knowledge. Skilled teaching practice balances these elements at several points in each student's learning about a topic.

Students can think curiously under two conditions:
- when they are guided and supported by their teachers to do so, and
- when they use curiosity thinking independently.

Our goal is the independent use of curiosity thinking. Our teaching needs to begin with supporting and scaffolding its use.

TWO TYPES OF CURIOSITY

TYPE 1 – EXPLORATORY CURIOSITY

Exploratory curiosity results when we mix the attraction of novel stimuli with taking risks. We are resolutely inquisitive about something that is new. Exploratory curiosity leads us to explore our environment, to experiment with novel physical and social experiences.

It is sometimes called 'sensory curiosity' because it is linked with seeking out thrills and experiences that alleviate boredom.

Knowledge is acquired, and learning does occur, through exploratory curiosity. But the main purpose of this type of curiosity is to experience thrills and sensations.

> *When the Rabbit actually TOOK A WATCH OUT OF ITS WAISTCOAT-POCKET, and looked at it, and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and burning with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit-hole under the hedge.*
>
> *In another moment down went Alice after it, never once considering how in the world she was to get out again.*

TYPE 2 – INTELLECTUAL CURIOSITY

(IM) Intellectual curiosity is the desire to learn new ideas, to discover more about something that interests you. It is associated with motivations for academic achievement.

Intellectual curiosity stimulates observation, consultation, and directed thinking (or specific exploration). These behaviours result in knowledge acquisition and learning.

Intellectual curiosity:
- is linked with *convergent thinking* – finding the one solution to a question
- leads to creativity through *divergent thinking* – seeking relevant answers to a question.

> *'I must be getting somewhere near the centre of the earth. Let me see: that would be four thousand miles down, I think–' (for, you see, Alice had learnt several things of this sort in her lessons in the schoolroom, and though this was not a VERY good opportunity for showing off her knowledge, as there was no one to listen to her, still it was good practice to say it over) '–yes, that's about the right distance–but then I wonder what Latitude or Longitude I've got to?' (Alice had no idea what Latitude was, or Longitude either, but thought they were nice grand words to say.)*

Teachers ignite intellectual curiosity. It is important for your students to know that you value and use your own intellectual curiosity.

For a topic you are teaching:
- (PE) plan first how you will stimulate exploratory or sensory curiosity through novelty, surprise, and unexpectedness
- (PK) then stimulate intellectual curiosity by guiding and scaffolding students to question, analyse, and unpack the novelty.

PERSONAL RESERVES OF CURIOSITY

It is useful to distinguish between state curiosity and trait curiosity.

STATE CURIOSITY

Curiosity is a common human state. State curiosity is shown when people enquire into events they haven't experienced before, or when they think about abstract ideas.

TRAIT CURIOSITY

Curiosity is a trait. Some people are more curious than others. And different people are curious about different topics.

Trait curiosity varies between people according to:
- the *breadth* of their curiosity (the range of topics they are interested in), and
- the *depth* of their curiosity (the level of interest in a single topic).

This means that some events are more likely to elicit curiosity in some people than in others.

IMPLICATIONS FOR TEACHING

A valuable way of stimulating state curiosity is to introduce surprising information that acts as a hook for the topic.
(PE) Surprising information elicits responses like **'That can't be right!'** or **'I didn't expect that!'**

State curiosity can be sustained by rewards. Your feedback can help a student recognise that their curiosity has worked for them. Over time, this kind of awareness is
(PK) internalised. For example, students develop the self-awareness that 'it's because I asked these questions that I got a useful answer.'

A challenge for teachers is to stimulate the curiosity of students with relatively low trait curiosity. It can be built
(IM) up over time by encouraging students to reflect on what is useful about learning new information and new skills.

QUESTION 2

WHAT ARE THE CHARACTERISTICS OF CURIOSITY THINKING?

Lewis Carroll's *Alice in Wonderland* is about doing curiosity thinking.

In Chapter 1, Alice pursues a White Rabbit down a burrow, after she sees him consult a pocket watch. From that moment on, every perplexing experience involves Alice asking questions of herself and others she meets. As Alice wends her way through Wonderland, she is doing curiosity.

In Chapter 2, she is surprised but accepts the peculiar circumstance that she is quickly growing bigger and bigger.

> *'Curiouser and curiouser!' cried Alice (she was so much surprised, that for the moment she quite forgot how to speak good English).*

Strange things are noticed and wondered about.

> *'What a funny watch!' she remarked. 'It tells the day of the month, and doesn't tell what o'clock it is!'*

Odd statements are queried.

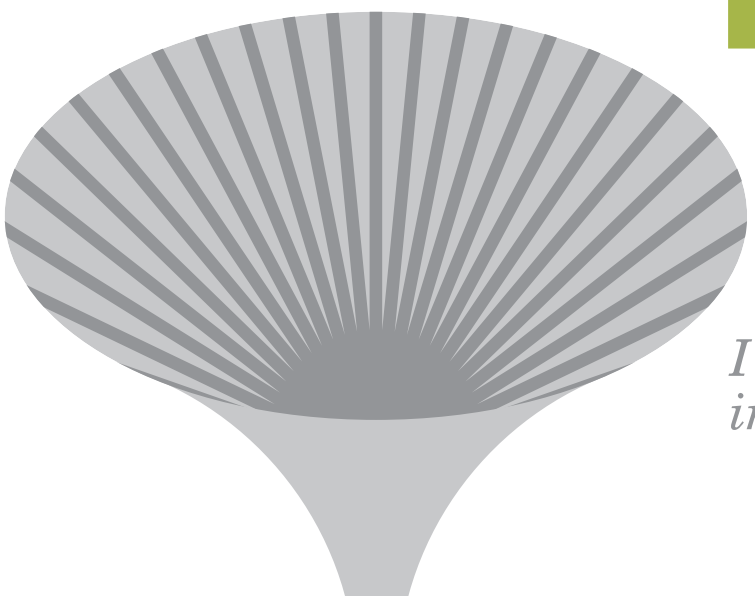
> *The master was an old Turtle–we used to call him Tortoise–'*
>
> *'Why did you call him Tortoise, if he wasn't one?' Alice asked.*
>
> *'We called him Tortoise because he taught us,' said the Mock Turtle angrily: 'really you are very dull!'*

In Wonderland, one astonishing episode leads to another. Alice wants to understand the outlandish beings she meets and the odd events in which she is caught. Her best strategy is to engage, to apply her existing knowledge, and to seek out new knowledge that will help to make sense of it all. To do curiosity thinking.

SEVEN CHARACTERISTICS OF CURIOSITY THINKING THAT SUPPORT LEARNING

Alice's excursion in Wonderland is characterised by seven aspects of curiosity thinking that support powerful learning.

1	**Alice was engaged**	The events Alice encountered attracted her interest. She was engaged. She was willing to accept new ideas, new people, new thoughts, and new things.
2	**Alice accepted the unexpected**	What Alice experienced was not what she expected. Her existing knowledge told her these were unusual events.
3	**Alice set goals despite uncertainty**	She framed goals that focused on trying to know more about the experiences. Alice is prepared to run with ideas that don't immediately 'make sense'. Being curious asks us to: – accept ambiguity – move into a domain where what we already know is insufficient – be prepared to take risks and make errors – be ready to change our thinking.
4	**Alice was optimistic that she could work things out**	Alice accepted that events in Wonderland were unusual, and she believed she could learn more about them. She had self-confidence or self-efficacy in her capacity to learn more. Her 'optimism' was founded on a belief that ultimately she would be successful. Alice made errors and saw them as an opportunity to learn and so move closer to her goal of understanding.
5	**Alice built on what she already knew**	To help unpack the situations she found herself in, Alice framed questions linked with what she already knew. She inferred and predicted. She questioned cause and effect, motives, attitudes and feelings.
6	**Alice took her time**	Alice sustained her curiosity by asking questions that drew in new ideas, and giving herself time to assemble new interpretations and understanding.
7	**Alice was persistent**	Alice was persistent. She maintained focus until her curiosity in each event was satisfied. Alice also allocated energy to thinking attention – the mental energy to think through a problem or confront something unknown. This kind of energy is essential for curiosity.



I know something interesting is sure to happen

QUESTION 3

WHAT DOES CURIOSITY LOOK LIKE IN THE CLASSROOM?

CURIOSITY AND IMPLICATIONS FOR TEACHING PRACTICE

Lewis Carroll has provided a valuable perspective on what we do when we are 'being curious'. *Alice in Wonderland* is a delightful primer on the actions, ways of thinking, and attitudes, that constitute curiosity thinking.

This manual concentrates on assisting teachers and schools to enhance students' skills in curiosity thinking. On page 4 we sketched out the features of curiosity, and on page 5 we sketched out the characteristics of curiosity thinking. From these features and characteristics flow nine aspects of teaching for curiosity thinking. The table on the facing page describes these aspects.

ELABORATION

Curiosity thinking is a suite of skills that help our students to improve how they approach learning.

Improvement relies on teachers supporting students to develop skills and understanding that enable them to 'do' the seven kinds of curiosity thinking described on page 5.

We believe that if students know how to apply curiosity thinking, the quality of their learning outcomes will rise.

Our teaching needs to help students understand curiosity thinking as:

- an identifiable element in their conceptual knowledge and experience
- a key learning skill
- an attitude and disposition to inquiry, and
- a core part of their identities as learners.

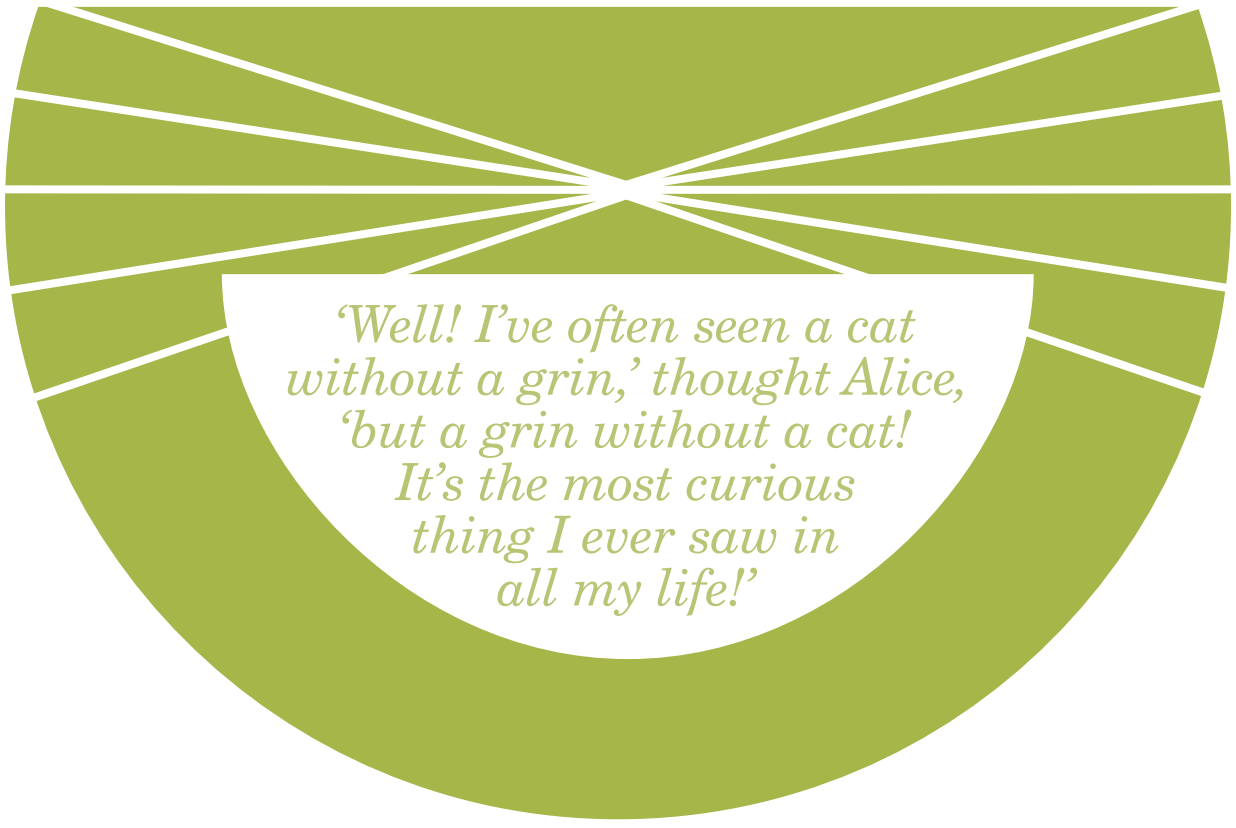
Curiosity thinking can have this kind of presence when:

- it is explicit in the classroom strategies we use to develop, refine and inspire our students' knowledge, and
- it is systematically acquired and reflected on.

The aspects of teaching described on the opposite page provide a framework for teaching students about curiosity thinking.

In *Curiosity and Powerful Learning*, one the manuals in the Powerful Learning series, we list four Whole School Theories of Action and six Theories of Action for teachers. Each of these Theories of Action propels powerful learning. Each is advanced when students value curiosity and engage in curiosity thinking.

Alice's adventures in Wonderland exemplify each of the Theories of Action for teachers. Alice acted as a self-directing learner. She certainly employed higher order questioning systematically, used learning intentions and was willing to take risks, set learning tasks for herself that were purposeful, clearly defined, differentiated and challenging, and used linked data and feedback. You might say she used a 'virtual cooperative group' with her cat Dinah to reflect on how she would deal with particular challenges and issues she confronted.



IMPLICATIONS FOR TEACHING

Nine aspects of teaching for curiosity flow from the features of curiosity and the characteristics of curiosity thinking presented on pages 4 and 5. We will return frequently to these aspects of teaching in this manual.

ASPECTS OF TEACHING FOR CURIOSITY THINKING – WHAT WE NEED TO TEACH EXPLICITLY

1	**Teach students to link positive emotion with what they learn and know**	Encourage your students to link interest and positive feelings with the topics they learn. By linking positive feelings with what they learn, our students: – are more likely to be curious about related topics in future, and be more motivated to learn about them – recall more easily what they have learned already.
2	**Teach students to build a positive identity as curious learners**	Our teaching can foster positive attitudes to curiosity. When students believe they can be successful at curiosity thinking, they are more likely to use it independently, and to take intellectual risks. When our students are open to new ideas, they are more likely to engage in learning and to think seriously about them.
3	**Teach students how to use what they know when they encounter unfamiliar information**	A student is more likely to be curious about a topic when they can use what they know about the topic to interpret new information. Curiosity is influenced by how well they can readily recall what they know. When a learner encounters an experience that challenges expectations, they can call on what they know to help interpret it. Self-dialogue is a key way to recall what we know. We can support our students to become curious by teaching them to talk to themselves about unfamiliar situations.
4	**Teach students to meet challenges by framing goals that focus on trying to understand or know more**	It is easier to focus curiosity and thinking activity when we know or can clarify what we are curious about. Teach your students to frame goals that focus on trying to understand or know more about a target experience. Teach them to value ambiguity and to run with ideas that may not make sense immediately.
5	**Teach a willingness to resolve challenges by taking a risk**	Being curious means moving into domains where what you already know is insufficient. This presents challenges that will take intellectual risks to resolve. Teach your students a positive attitude towards taking risks, making errors, and changing their thinking. Help them to learn what taking an intellectual risk actually 'looks and feels like', and to describe taking a risk as 'stretching' what they know or understand.
6	**Teach in ways that build students' self-confidence or self-efficacy in their capacity to learn**	Teachers play a foundational role in developing attitudes to learning. Constructing a positive identity as a curious and successful learner means being optimistic about learning and having self-efficacy, or trust in, our capacity to learn about unfamiliar and difficult topics. This entails a belief that whatever they do, they will ultimately succeed. They regard errors as learning tools that bring their learning goals closer.
7	**Teach students how to ask questions about topics that are linked with their learning goals**	Our students can learn to ask a range of questions that unpack topics they are learning about. Through questioning they can: – ask and answer questions that involve, for example, inferring, predicting, analysing, and evaluating – identify relationships such as cause and effect, and – infer motives, attitudes and feelings.
8	**Teach students how to draw in new knowledge and understanding by asking questions**	It is important that our students learn how skilled questioning helps to: – articulate what they have learnt through linking new ideas with what they already knew – describe how their knowledge has changed – identify the questions they can answer now – when we are curious it's because we want to know more.
9	**Teach students how to use persistence and determination to maintain focus on learning and thinking goals**	Support your students to learn how to: – articulate at any time their learning and thinking goals – visualise and prepare 'learning pathways' that lead them to their goals, and – review/keep track of progress towards their goals. When your students persist in moving towards learning and thinking goals, offer positive feedback that specifies this behaviour.

QUESTION 4

WHAT DO BRAIN STUDIES TELL US ABOUT CURIOSITY?

INTRODUCTION

Neuroscience is surprising us with new insights into how learning occurs. This brief overview of neurological activity that occurs when curiosity is fired can help us unpack what makes curiosity and learning such close companions.

Every learner starts with an advantage because curiosity appears to be an innate capacity. For example, we have evidence that infants across the world display curiosity in their preference for new images rather than familiar images. For students and teachers, the task is to turn curiosity into a powerful learning tool.

ELABORATION

Let's look at one set of brain scan studies that measured adult brain activity related to curiosity. In these studies participants responded to trivia questions.

The findings suggest that when people experience curiosity there is noticeable activity in those parts of their brains in which:

– ideas are comprehended and anticipated, and
– ideas act as rewards.

Participants displayed curiosity when answering the trivia questions. Finding the answers was correlated with activity in the caudate region of the brain which is involved in reward anticipation.

The brain scans showed that curiosity enhances memory – the ability to recall knowledge at a later time. The trivia questions that elicited higher curiosity (because the answers were anticipated to be more rewarding) triggered activity in the caudate region. This led to activity in another part of the brain that is crucial in consolidating long-term memory and learning new ideas.

When the trivia players guessed incorrectly, their curiosity about the correct answer was matched with increased activity in memory areas. It seems that curiosity may enhance memory for new knowledge that is surprising or unexpected.

A person's confidence level affects the extent of caudate activity. The more confident you are that you have the correct answer, the more positive feedback you expect. Responses to feedback, particularly to wrong guesses, were correlated with activity in parts of the brain involved in verbal memory. This suggests that curiosity helps to strengthen the memory of a correct answer, after a person makes an incorrect guess.

It's worth noting that expecting feedback is enough to stimulate the caudate – that part of the brain involved in reward anticipation.

The evidence from these brain studies fits the 'information gap' model of curiosity which holds that:

(IM) – curiosity is linked with *anticipating* new knowledge, and
– new knowledge can act as a *reward*.

To recap, it appears that curiosity:

– is linked with the reward value of knowledge
– supports learning from new information
– links memory with reward anticipation
– helps to consolidate new information in memory.

IMPLICATIONS FOR TEACHING

When our students experience curiosity, there is increased activity in parts of their brains that:

– comprehend information and anticipate ideas, and
(PE) – link ideas with positive emotions – we value the new knowledge and see it as worth learning.

Intellectual curiosity involves our students generating questions or enquiries about information, with the goal of knowing more about it. Being curious means our students (PK) pursue new knowledge or understanding they believe is valuable or useful. To grasp new knowledge, they look for or anticipate getting feedback that will help them evaluate what they know.

Curiosity enhances memory, particularly when positive emotions are linked with new ideas. It helps us organise new knowledge in long-term memory, consolidating it with what is already known. Curiosity prompts us to ask questions about how the new ideas link or fit with what we know.

Considering the evidence from brain studies, the key aspects of teaching for curiosity thinking (from page 7) are:

Teach students to link positive emotion with what they learn and know

Teach students how to use what they know when they encounter unfamiliar information

Teach in ways that build students' self-confidence or self-efficacy in their capacity to learn

Teach students how to ask questions about topics that are linked with their learning goals

Teach students how to draw in new knowledge and understanding by asking questions.

QUESTION 5

WHAT LEARNING PROCESSES DOES CURIOSITY DRIVE?

INTRODUCTION

The overview of brain studies on page 8 showed the key brain processes that are stimulated by curiosity. Here we delve a little further into curiosity thinking, looking at the learning processes, or ways of thinking, that characterise the two types of curiosity outlined on page 4 – exploratory curiosity, and intellectual curiosity.

We can enrich our teaching strategies if we bring together:
- what we know about brain activity, and
- what we know about cognitive activity during episodes of curiosity.

ELABORATION

David Beswick has researched curiosity for several decades. His comprehensive cognitive model of curiosity draws on Piaget's concept of cognitive conflict. A person experiences cognitive conflict when they realise what they know doesn't allow them to understand fully the new information before them.

Our first response to novelty is to use our exploratory curiosity, which engages with the new information. We call on what we already know in our attempt to resolve the conflict by interpreting or making sense of the new information.

Sometimes we do not experience high levels of curiosity when we are confronted with new information. We do not experience substantial conflict because we readily interpret new information in terms of what we know already. This can occur when:
- our existing knowledge is not sufficiently differentiated to allow the new information to cause much conflict. For example, a Year 12 mathematics student is more likely to pick up an error in mathematical reasoning than a Year 6 student
- anxiety stops us from perceiving the unique characteristics of new information. For example, a student who is anxious about reading aloud may not respond to questions about how the text they are reading differs from what they know.

Highly curious people see more clearly the uniqueness in new information and attempt to get the 'best possible fit' with what they know. To resolve the conceptual conflict they engage their intellectual curiosity. They question, analyse, and evaluate both what they know and the new information. This leads to change in existing knowledge.

Beswick's model assumes the brain operates in such a way that it naturally and continually pursues a systematic integration of what is known — we are constantly redrawing the cognitive map of our world. We unpack the information, identify what is new, and attempt to represent this by modifying what we know. In other words, we resolve the cognitive conflict by engaging our intellectual curiosity.

IMPLICATIONS FOR TEACHING

Beswick's model of curiosity recommends that teachers guide and scaffold students to navigate 'cognitive conflict' as a means of learning. There are four components to this teaching approach.

FIRST, foster your students' curiosity initially through exploratory curiosity by using novelty, and then engage their intellectual curiosity.

SECOND, assist your students to 'get their knowledge ready' for being curious about a topic. Guide them in how to differentiate their existing knowledge. Differentiation will support their analysis of new information – it makes analysis more effective and limits or dispenses with negative emotional reactions.

THIRD, help your students recognise the uniqueness of new information and motivate them to construct the 'best possible fit'.

This may include teaching your students how to resolve the conceptual conflict by explicitly teaching how to question, analyse, and evaluate both what they know and the new information.

Questioning, analysing, and evaluating are strategies that ask teachers to progressively develop their students' skills so they can self-initiate inquiry (rather than wait to be led).

FOURTH, foster students' willingness to:
- tolerate ambiguity
- take risks, and
- move out of their comfort zones.

Beswick's model of curiosity engages all the aspects of teaching for curiosity thinking that are listed on page 7. In particular, the following aspects of teaching assist in resolving conceptual conflict:

Teach students how to use what they know when they encounter unfamiliar information
Teach students to meet challenges by framing goals that focus on trying to understand or know more
Teach a willingness to resolve challenges by taking a risk
Teach students how to ask questions about topics that are linked with their learning goals
Teach students how to draw in new knowledge and understanding by asking questions.

QUESTION 6

GOOD QUESTIONS!

INTRODUCTION

A signature characteristic of curiosity thinking is applying questioning techniques. It's important to emphasise, as the brain studies show, that motivation to learn is not sustained simply by asking questions. It is sustained by identifying, explaining, and using the new knowledge and understanding that results from asking and responding to questions. Curiosity questioning is a means for achieving new understanding.

Teachers can enhance their students' motivation to learn by fostering their ability to ask various kinds of questions and to pursue answers to them.

The next four pages concentrate on questioning technique as an aspect of curiosity thinking that propels powerful learning.

QUESTIONS FOR TEACHERS

Questions are important devices for energising and directing learning. As teachers, we ask a lot of them. One study found that teachers may ask up to 150 questions per hour in primary grade social science and science lessons. It's important to reflect on the kinds of questions we ask and what the evidence tells us about questioning techniques.

For example, we may believe that students learn best when our questions challenge what our students know – that is, when we ask academic questions. Yet the evidence suggests that the frequency of academic questions is only moderately associated with academic achievement.

Questions that ask students to explain, comment, give their opinion, or evaluate are more likely to stimulate longer answers.

Questions that tap well-established knowledge are more likely to stimulate discussion among students. For example:

- How does sorting things help us at home or at school?
- We get feedback all the time, from our friends, our families, our teachers. What kinds of feedback do we take the most notice of?

If our aim in a lesson is to foster whole class or small group discussion then questions may not be as effective as 'non-questions'. Non-questions can also cause us to reflect on and analyse what we know. They don't however, have the question form. Examples of non-questions include:

- Describe some ways in which you think that chance is fair and unfair
- Let's see if we can make sense of the main character's motives for keeping secrets.

About 80% of the questions we put to our students require them to recall information they have learned already. Yet we know that curiosity is driven by questions about new information, and by questions that help us link this new information to what we already know.

THE IMPORTANCE OF WAIT TIME

Whatever questions we ask, it is essential to give students time to pursue curiosity thinking. There are two kinds of wait time that support curiosity thinking.

WAIT TIME	1	**The time we wait for a response to a question.** The average wait time given by primary teachers ranges from 1.5 to 3.9 seconds.
WAIT TIME	2	**The time we wait between the person responding to one question before we ask the next question.** The average wait time given by primary teachers ranges from 0.6 to 2.2 seconds.

Consistently extending wait time from 1 second to 3 seconds has several positive impacts on student responses:

- responses are longer
- the number of spontaneous and relevant responses increases
- failure to respond decreases
- student confidence in responding improves
- the number of speculative responses increases
- the likelihood of inferences based on evidence increases
- there is an increase in the number of different approaches to a question or problem
- students are more likely to stay focussed on a question or problem.

Student responses to our questions improve when they know they have longer to process questions, organise their thoughts, and to look at ideas in different ways.

Wait time sustains curiosity.

'Come, we shall have some fun now!' thought Alice. 'I'm glad they've begun asking riddles.'

TEACHING STUDENTS HOW TO QUESTION

Effective curiosity thinking enables our students to:

- re-organise what they know
- form frameworks they can hang ideas on as they learn
- dig deeper into ideas and explore connections between them
- look at an idea from different perspectives so they can elaborate, enrich or broaden their understanding
- transfer and generalise their knowledge
- show what they know
- respond confidently to assessment tasks.

(PK) To achieve these outcomes students need to know how to generate their own questions – questions that draw in new interpretations.

LEARNING HOW TO ASK QUESTIONS

Students need to learn how to ask questions, both of themselves as they are learning, and of the ideas they are learning about. Learning how to ask questions is assisted if we:

- are explicit about the objective of different kinds of questions, and
- (IM) help students to ask themselves, their peers and you the kinds of questions likely to sustain their motivation and advance their learning.

	OBJECTIVES	EXAMPLES
1	**To frame a learning purpose or a goal**	– Why am I learning this? – What might I know when I have finished learning? – How will I use the ideas that I will understand?
2	**To monitor progress**	– Where was I with this idea fifteen minutes ago? – Where am I now with this idea? – Where will I be with this idea in fifteen minutes?
3	**To link what I know with the new ideas**	– What do I already know about this topic? – What does this task/problem/idea remind me of? – What have I learned already that is like this new idea? – What might this idea be about? – What ideas might come up? – What questions might this story answer?
4	**To make calculated guesses to take risks, to try out my ideas and see how well they work and then to accept, reject or modify them**	– What is my best guess about what this idea means? – How can I compare this new information with what I have already learned about this topic? – What changes if I compare this new information with what I have already learnt about this topic?
5	**To transfer or generalise what I have learnt to other situations**	– Where else can I use these ideas? – In what situations will I need to use these ideas?

EXPLICIT TEACHING ABOUT QUESTIONING

We can help our students to learn about different types of questions when we are explicit about what kinds of questions we ask them. During a lesson about fire engines, we could ask questions like these and explain what kind of questions they are.

QUESTION	EXPLANATION
What colour are fire engines?	This question is asking you to recall information from the story we have just read
Why do you think fire engines are painted red, rather than brown or blue?	This question is asking you to think about the information in the story
Do you think that it is a good idea to paint fire engines red?	This question is asking for your ideas about the information in the story
Did you feel what it would be like to be a fireman as you read the story?	This question is asking you about your feelings

MAINTAINING A CLASSROOM CURIOSITY CULTURE

(PE) Our students are more likely to develop effective questioning skills if we establish and maintain a curiosity culture in every classroom. We can establish a curiosity culture in our classrooms in several ways.

CHARACTERISTICS OF CURIOSITY CULTURE
Extended wait time is used consistently
Students are encouraged to answer questions even if they find them difficult. If they find a question difficult we assist them to frame questions for themselves that will help them to respond.
Students know that we value best guesses and taking a risk. They know that we will help them to learn how to modify their guesses: – *Great, you've had a go at spelling the word. Now say it again and look where you might change what you've written.*
Teachers model making guesses and are explicit about how they manage the process of 'guessing intelligently'.

GOOD QUESTIONS!
FOUR TYPES OF QUESTIONS

There are four types or categories of questions that teachers have considerable expertise in asking. The challenge is to become skilled in using questions that assist our students at various points in their learning.

QUESTION TYPE 1	**Questions we ask to stimulate curiosity when beginning a new topic**
QUESTION TYPE 2	**Questions we ask to sustain curiosity during learning**
QUESTION TYPE 3	**Questions we ask after students have learned new ideas**
QUESTION TYPE 4	**Questions we ask to help students transfer ideas to new situations**

QUESTION TYPE 1: QUESTIONS WE ASK TO STIMULATE CURIOSITY WHEN BEGINNING A NEW TOPIC

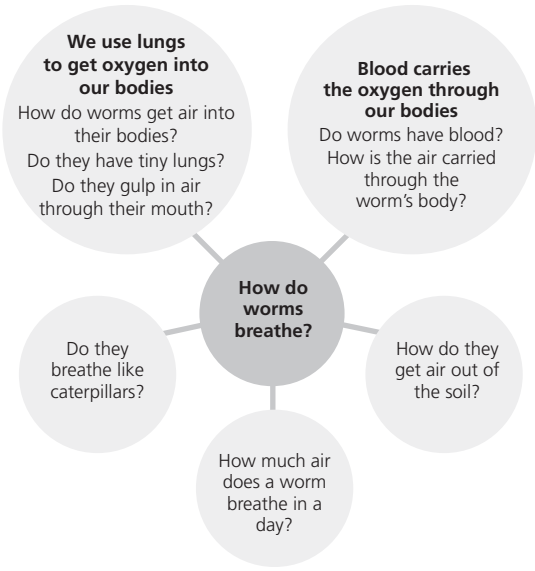
These questions stimulate interest and engage initial curiosity. They encourage students to frame their learning goals and to activate existing knowledge.

Challenge questions attract students' attention These can be 'what if?' questions	– Suppose you want to buy a new car. Would it cost you less to buy it from a showroom here or fly to China, buy the car there and transport it back home?
Questions that help students to link new ideas with what they know	– What is the purpose of a McDonald's commercial? – What French words do we use in English? – What do you already know about this topic?
Questions that help students to see where the learning is going, to imagine or describe possible outcomes of the lesson	– What ideas might come up during this topic? – What questions might it answer? – What will I know about when we finish this lesson?
Questions that direct attention to experiences students have had	– When have you been aware that earthworms have died? – Why do you think they die when they are left in the sun or the soil is too dry?
Questions that highlight similarities and differences between what the student knows and the challenges posed by a new topic	– We've learned the rules of softball so we can play the game. Does this mean we can all umpire a game of softball? – Last time we learned about meteors flying through space. Could a meteor hit the Earth?

Another way of firing exploratory curiosity is to pose questions that provide an advance organising framework on which they can hang ideas as they learn.

Let's say your new topic is about how earthworms breathe and the class has already learned that:
– humans use lungs to get oxygen into our bodies
– blood carries the oxygen through our bodies.

Ask your students to suggest questions about worms' breathing. Organise them visually and begin exploring the topic using their questions as a starting point.



QUESTION TYPE 4: QUESTIONS WE ASK TO HELP STUDENTS TRANSFER IDEAS TO NEW SITUATIONS

These questions motivate students to use their intellectual curiosity. They encourage students to see how their new knowledge can be applied in a range of contexts and to future learning goals.

Questions of this type look at an idea from different perspectives. You can generate this type of question using frameworks like de Bono's Six Hats, Taylor's Multiple Talents Model, or Bloom's taxonomy.

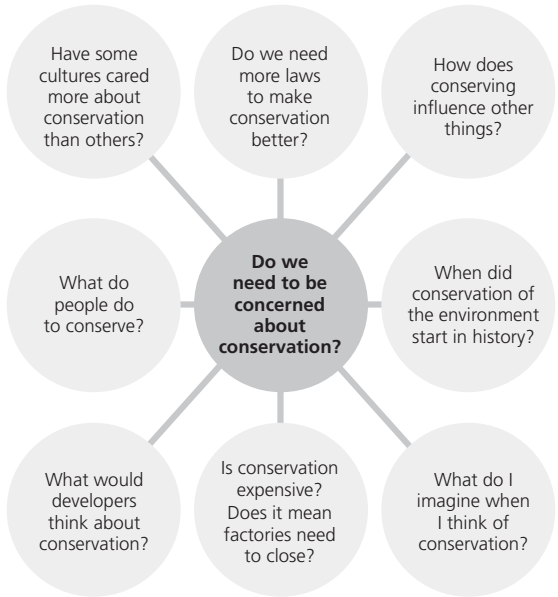
Ask questions that help to transfer and generalise knowledge	– Where might we use these ideas? – Would these ideas be useful in a different situation? – What questions could we ask now that we couldn't ask before?
Ask questions that apply the knowledge in new and different situations	– How would a worm behave if the soil it was moving through suddenly became very moist?
Ask questions that distinguish between situations in which the newly learned idea could be used and could not be used	– How do you know that caterpillars don't breathe the same way earth worms breathe?

QUESTION TYPE 2: QUESTIONS WE ASK TO SUSTAIN CURIOSITY DURING LEARNING

These types of questions encourage students to probe their knowledge further, and to explore why and how their knowledge needs to be modified.

Questions that analyse and generalise ideas	– Why did that happen? – What is this lesson about? – If X and Y have already happened, why is Z happening now?
Idea elaboration questions that look at ideas from different perspectives and help to restructure knowledge	– What about this example? – Does it fit with what we've just learned?
Bring new ideas together and link them in novel ways	
Visualise the ideas in various contexts to see which parts change, what they have in common	– Imagine harvest time in Ancient Egypt. Look across the fields and describe how the farmers cut and bundled and transported the wheat. How is it different from harvesting today?
Extend or interpolate the idea	– How far can you take this idea? Will it apply in extreme conditions?
Dig deeper into an idea by using questions to guide how connections are explored	– Would this be true when …? – How would humans have to be different so that we could breathe like earthworms? – Is the earthworm's breathing more efficient than ours?
Ask questions that reflect on what they would do in various situations related to the topic	– What would you do if…?
Ask questions that help students specify their learning progress	– How much have you learnt? – What bits do you still need to work on?
When presented with unfamiliar ideas that they don't think they know much about, help them to frame a series of questions that link the new ideas with their existing knowledge	– What does this problem remind me of? – Is this task like something I already know? – What is this topic about and what ideas might come up? – What do I know about this topic already? – What will I do first, what I will do second?

Again, questions that sustain curiosity during learning can be represented visually.



QUESTION TYPE 3: QUESTIONS WE ASK AFTER STUDENTS HAVE LEARNED NEW IDEAS

Curiosity is sustained and more likely to be engaged in the future when students see that being curious allows them to learn new things.

This type of question assists students to store ideas in long term memory, and to recall them. These questions help students to summarise their new learning, and to visualise how their new learning can be useful for future learning.

Ask students to describe how their knowledge has changed **(Encourage them to use the new words or terms or symbols they have learned)**	– How do earthworms differ from us in how they breathe? – How are they similar to us? – Which other animals are in the same group as humans and which are in the same group as worms?
Ask questions that help them to demonstrate their own learning to themselves	– What can I answer now about how earthworms breathe?
Ask questions about when ideas might be used in the future	– In what situations might you have to show you've learnt these ideas?

Because they have learned new ideas, your students are in a position to ask many questions of themselves and their peers. Strategies you can use to engage your students in framing their own questions include asking them to:

- work together in small groups to make up easy and difficult questions for other groups
- paraphrase or summarise the ideas for a small group or for the class, make a poster, write a newspaper article, or conduct an interview with their classmates
- recall the ideas in various formats and contexts, such as completing incomplete statements, or drawing concept maps.

QUESTION 7

HOW CAN WE DEVELOP POSITIVE ATTITUDES TOWARDS CURIOSITY?

INTRODUCTION

Attitudes are beliefs we have about an idea, a person, a thing or an event.

Our attitudes towards curiosity are revealed by how we link values, feelings and dispositions with topics and subjects. Our students may be curious if a topic interests them. They may be less curious if they feel a subject is not useful to them.

There is a continuum of student attitudes towards being curious. At one end, curiosity is not valued at all. At the other end, curiosity is valued as a great way of thinking and learning.

Teachers help their students fashion the tools they need for lifelong learning. One of the tools they will use most often is a sharp sense of how to use their curiosity when they encounter new ideas.

KRATHWOHL'S TAXONOMY

Krathwohl's taxonomy of attitudinal dispositions helps identify student attitudes towards being curious, and helps teachers to improve their students' attitudes towards curiosity.

This table is a tool for opening a pathway to a positive attitude or disposition to curiosity. In the left column, Krathwohl's sequence (or taxonomy of attitudinal development) is adapted to focus on curiosity. In the right column are examples of behaviours that indicate the degree of emphasis on curiosity that matches each stage in the developmental sequence.

KRATHWOHL'S TAXONOMY OF ATTITUDES TOWARDS CURIOSITY

1 = less positive 5 = more positive		**Examples of related attitudinal behaviours**
1	**Prepared to receive or to attend to unfamiliar or conflicting information**	Students are not self-initiating their learning. Instead they depend on the curiosity of others. They are prepared to observe other people being curious, but are not prepared to pursue intellectual curiosity by themselves Students are not prepared to unpack or question new ideas or information spontaneously
2	**Respond curiously to information, use curious thinking spontaneously**	Students are prepared to activate their curiosity Students interact with novel information spontaneously – they unpack it, question it, try to learn more about it independently
3	**Value the idea of curiosity – see curiosity as having some worth**	Students show they value curiosity by mostly choosing it over other dispositions Students look for contexts in which they can use their curiosity
4	**Relate curiosity to one's life** *Curiosity is so valuable that it fits with one's value system*	In all aspects of their lives, students consistently choose curious over alternative dispositions
5	**Characterise the idea** *Curiosity is used as a means of organising one's values and forming one's 'world view'*	Students have a worldview that is directly and consistently influenced by curiosity thinking

ELABORATION

There are many influences on student attitudes to a topic, such as:

- prejudging that a topic will be boring or too difficult, based on their learning experience with similar topics
- believing they know enough about a topic – if there are no more questions to answer, curiosity is superfluous
- feeling gripped by a topic because it holds unanswered questions for them
- finding new information that doesn't match what they know already, prompting them to ask questions.

Students are more likely to engage their curiosity if two conditions are met.

CONDITION 1	CONDITION 2
A positive disposition to curiosity	**Curiosity is part of their identity as a student**
Students believe curiosity is a valuable activity in which to engage	Students believe they are curious and that they know how to use curiosity thinking
'Curiosity works for me'	*'I like framing questions to help me find out more'*
versus	**versus**
'Curiosity never gets me anywhere'	*'Questions are frustrating'*
'I like being curious about history – there are always hidden stories about how people lived'	*'I can learn about this topic if I ask questions about what I already know'*
versus	**versus**
'What's so interesting about stuff that happened 5000 years ago?'	*'I will never be curious about maths because I don't understand it'*

IMPLICATIONS FOR TEACHING

This manual examines many ways in which teachers can influence students to strengthen and sustain positive attitudes towards curiosity.

Here we consider how reflections on curiosity itself can help our students to integrate curiosity into their worldview so that it becomes part and parcel of the ways they live, learn, and think. (IM)

Nine aspects of teaching curiosity thinking are listed on page 7. Each aspect is engaged when we guide our students to reflect on curiosity as a tool for learning. We can plan lessons that include inquiry into the nature and purpose of curiosity thinking. We can take advantage of teachable moments to open a brief investigation into an aspect of curiosity.

ATTITUDES THAT FOCUS INQUIRY

Examining attitudes is a fruitful way of assisting our students to probe the power that curiosity thinking has in their lives and learning. To guide reflection about curiosity we can focus inquiry on three aspects of attitudes.

ASPECT 1	ASPECT 2	ASPECT 3
What is my attitude to: – learning in general? – learning about specific topics/ subjects?	How is learning supported by positive attitudes to curiosity, being curious, and curiosity thinking?	How is learning limited by negative attitudes to curiosity, being curious, and curiosity thinking?

STRATEGIES FOR STRUCTURING INQUIRY

Reflection is assisted when we link together:
– the attitudes that focus inquiry, and
– the structure for inquiry.

Three strategies for investigation are suggested here. Small group and whole class discussion is valuable because experience is pooled.

OBJECTIVES	
OBJECTIVE 1	OBJECTIVE 2
To assist students to articulate their personal relationship with curiosity, being curious and curiosity thinking	**To encourage our students to adopt a positive attitude towards curiosity, being curious and curiosity thinking**

STRATEGIES		
STRATEGY 1	STRATEGY 2	STRATEGY 3
Cultivate awareness	**Build understanding through doing**	**Monitor change**
Explore the power of curiosity and curiosity thinking through personal reflection, small group discussion, and whole class discussion	During a learning activity, take a moment to review the role that curiosity thinking is playing in propelling learning	Assist students to monitor changes over time in their attitudes to, and understanding of, curiosity

INQUIRY TACTICS FOR TEACHERS

(PE) What tactics can you use at teachable moments in a lesson? Here is a selection:
– Without judgement, challenge student attitudes towards curiosity
– Encourage students to discuss instances in which learning happened because of the way they and their peers used curiosity
– Encourage students to recall how much attention and activity they invested when they used curiosity thinking
– Ask students to articulate the positive emotions they associated with being curious – with lots of wait time
– Encourage students to engage their curiosity frequently
– Devote time to imagining 'what might be' when they unleash their curiosity
– Help students to visualise a positive attitude to curiosity, being curious, and curiosity thinking:
  • what will that look like to others?
  • what will it feel like to me?
– Ask students to describe, as specifically as possible:
  • what they know about how to learn, and
  • when curiosity, being curious, and curiosity thinking are implicated in their descriptions
– Celebrate those moments on the learning journey when the outcomes of curiosity and curiosity thinking are worthwhile, useful, relevant to their lives, and match their values.

So many out of the way things had happened lately, that Alice was beginning to think that very few things were indeed impossible.

QUESTION 8

WHAT KINDS OF CLASSROOM DIALOGUE SUPPORT CURIOSITY?

INTRODUCTION

The language teachers and students use can either promote or restrict curiosity.

The way we use language in dialogue with our students has a powerful influence on our students' willingness and ability to be curious. Our dialogue can become students' self-talk about curiosity thinking. They can learn to tell themselves how to direct and manage their curiosity activity. For example, they can direct and manage:

- their 'tuning in' activity early in a learning session
- their exploration-discovery activity while learning, and
- their 'putting together' activity after learning the new ideas.

Dialogue is a strategic teaching resource. It has wide ranging impacts, from fostering initial curiosity in learning a topic, to laying foundations for enduring curiosity by emphasising and supporting persistence and resilience during learning.

ELABORATION

We are using the word 'dialogue' to mean more than a conversation. Consider these dictionary definitions of dialogue.

From the online *Oxford Dictionary*:

> *A discussion between two or more people or groups, especially one directed towards exploration of a particular subject or resolution of a problem.*

From the *Macquarie Concise Dictionary*:

> *An exchange of ideas or opinions on a particular issue.*

These definitions emphasise:

- focus on a specific topic
- exchange of views
- exploration
- resolution.

Together these definitions focus on dialogue as an interaction between ideas. Dialogue also refers to 'self-dialogue' or 'inner dialogue' in which a person analyses how new ideas sit with what they know. Self-initiated curiosity relies on self-dialogue.

On the facing page we describe nine kinds of classroom dialogue that foster curiosity. Each of these kinds of dialogue is underpinned by the attributes of focus, (PK) exchange, exploration, and resolution. There is one more underpinning attribute that characterises effective dialogue (PE) – a tone of respect.

The purpose, structure and tone of dialogue used in a classroom are strongly influenced by the school's prevailing culture. In classrooms, teachers have a leading role in determining how dialogue is used as a strategic resource that supports curiosity and powerful learning.

Classroom dialogue has many parties: teacher, each student and their peers, perhaps a student teacher, a teacher's aide, and classroom visitors. Classroom dialogue also has many forms, such as teacher facilitated whole class discussion, student facilitated whole class discussion, pairs on task, and small groups on task. Well honed professional skills and a strong grasp of pedagogy assist teachers to manage dialogue, and to establish the language used in dialogue.

IMPLICATIONS FOR TEACHING

The use of dialogue as a strategic teaching resource resonates with all the aspects of teaching for curiosity thinking that are listed on page 7. It is worth reflecting on these aspects in particular:

- Teach students to link positive emotion with what they learn and know
- Teach students to build a positive identity as curious learners
- Teach in ways that build students' self-confidence or self-efficacy in their capacity to learn
- Teach students how to draw in new knowledge and understanding by asking questions
- Teach students how to use persistence and determination to maintain focus on learning and thinking goals

TEACHER AND PEER DIALOGUE FOR FOSTERING CURIOSITY

Nine kinds of classroom dialogue that foster curiosity are shown on the opposite page. The kinds of dialogue, and their important characteristics and purposes, draw on:

- Features of curiosity (page 4)
- Seven characteristics of curiosity thinking that support learning (page 5)
- Beswick's cognitive model of curiosity (page 9)
- The art of questioning (pages 10-13)
- Krathwohl's taxonomy of attitudinal dispositions (pages 14 and 15)
- Three Phase Knowledge Enhancement Framework (pages 18 and 19).

The skill for teachers lies in determining which kinds of dialogue are best suited to the learning phase that a student or a class has arrived at.

CURIOSITY IS FOSTERED WHEN WE USE DIALOGUE TO…	CHARACTERISTICS AND PURPOSES OF THIS KIND OF DIALOGUE
Catalyse or initiate interest, challenge or wonder (PE)	This kind of dialogue stimulates our students: – to attend actively to the topic and learning activities – to accept that the topic and learning activities are challenging what they know and how they think – to want to know more, to ask themselves who, why, what, how, when, how much…
Explore (IM)	Exploratory dialogue encourages and values open-ended exploratory thinking about an idea – what if, let's imagine…
Situate time as a resource for thinking (PK)	Wait time is a marker of dialogue that communicates to your students that they have time to think and to probe before responding to a question or statement, or before posing a clarifying question, or before proposing a strategy that will move them towards an answer…
Model curiosity thinking (PE)	Dialogue is an excellent avenue for teachers to model how to think curiously in a range of ways. Modelling validates curiosity in the culture of the school and the classroom.
Give positive feedback for being curious (PE)	Dialogue is an excellent avenue for learning how to give and receive feedback. You can demonstrate through feedback that you value curiosity, being curious and curiosity thinking. When you create the conditions for positive peer feedback about some aspect of curiosity, you contribute to a peer culture that values curiosity. This is particularly important during adolescence.
Value conceptual conflict as a resource for thinking (PK) (PE) (IM)	This kind of dialogue intentionally draws your students' attention to conceptual conflicts. It is especially useful to draw attention to circumstances in which students' expectations or predictions about an idea, or the outcome of a learning activity, are not met. Take time to explore the unexpected and the surprising.
Promote questioning as a learning strategy (PK)	This kind of dialogue uses questioning and inquiry, rather than telling, to teach your students how to speculate and how to look for links between ideas. Your ability to use questions in dialogue helps students to see how framing and pursuing questions is a strategy for learning.
Generate choices among ideas (PK)	Through dialogue you can draw your students' attention to the multiple options and choices ideas throw up. Dialogue is a tool for weighing up, analysing and contrasting options and choices.
Increase the level of stimulation (IM)	You can use a brief dialogue to increase curiosity by, for example, probing an idea or interpretation.

QUESTION 9

HOW DO I BUILD CURIOSITY INTO A LESSON PLAN?

INTRODUCTION

The single most important approach we can take is to (PK) teach so that our students have opportunities to discover for themselves how curiosity helps them to learn, and to solve problems or challenges.

Brain imaging research and models of curiosity emphasise two factors about learning:

- a learner's existing knowledge is engaged whenever new learning occurs
- (PE) positive emotion produces positive feedback about the new learning.

ELABORATION

The objective of the teaching practice described here is to stimulate curiosity and learning in a lesson.

The practice is based on a Knowledge Enhancement Framework that has two essential characteristics:

- first, that learning any idea proceeds through three 'phases of learning', and
- second, that curiosity can be developed and fostered at each phase.

THREE PHASE KNOWLEDGE ENHANCEMENT FRAMEWORK	
LEARNING PHASE 1	Learning occurs, and is accelerated, when a learner: – stimulates what they know already – decides on a purpose or reason for learning.
LEARNING PHASE 2	Initially, a new idea is learned in a limited way. Gradually, a learner broadens their understanding of the new idea. The learner links emotions with the new idea.
LEARNING PHASE 3	The learner reviews and consolidates what they learned – the new idea is encoded in long term memory. The learner can retrieve and apply the new idea. The learner can retrieve the new idea and use it in later learning.

…when the Rabbit actually took a watch out of its waistcoat pocket, and looked at it, and then hurried on, Alice hurried to her feet … and, burning with curiosity, she ran across the field after it.

IMPLICATIONS FOR TEACHING

The Framework draws particularly on the following aspects of teaching for curiosity thinking listed on page 7:

- Teach students to link positive emotion with what they learn and know
- Teach students how to use what they know when they encounter unfamiliar information
- Teach students to meet challenges by framing goals that focus on trying to understand or know more
- Teach students how to ask questions about topics that are linked with their learning goals
- Teach students how to draw in new knowledge and understanding by asking questions

TEACHING PRACTICE THAT HARNESSES CURIOSITY THINKING

The Knowledge Enhancement Framework matches teaching practice to each of the three Learning Phases.

Teachers need to:

- recognise curious behaviours over the course of a lesson
- know how to respond to those behaviours
- support their students to recognise, value and reward curiosity.

Krathwohl's taxonomy is shown on page 14. The taxonomy:

- indicates the types of curiosity behaviours to look for
- offers a guide for interpreting curiosity behaviours and responding to them.

Pages 10-13 of this manual explore the art of questioning. The teaching practices listed in the table at right rely on these questioning techniques as tools for stimulating and maintaining curiosity at each phase of learning.

THREE PHASE KNOWLEDGE ENHANCEMENT FRAMEWORK	
LEARNING PHASE 1	Learning occurs, and is accelerated, when a learner: – stimulates what they know already – decides on a purpose or reason for learning.
Matching Teaching Practice	Use explicit teaching that guides your students to: – decide on a reason for learning – stimulate what they know through curiosity thinking – use what they know as a basis for: • framing questions they can ask about the topic • imagining possibilities about where the topic could lead – challenge their existing knowledge – predict what they will know when they have learned the new ideas – decide on the questions they might be able to answer at the end of a lesson or a topic – speculate about what they might be able to do at the end of a lesson or a topic.
LEARNING PHASE 2	Initially, a new idea is learned in a limited way in particular contexts. Gradually, a learner broadens their understanding of the new ideas involved in a topic. The learner links positive emotions with the new ideas.
Matching Teaching Practice	Use explicit teaching that guides your students to: – grasp new ideas by making new links – this means questioning how new understanding can be applied in a range of contexts – generate a range of examples that show the new ideas in action – link emotion, interest, value, usefulness with the ideas they are learning – see themselves as successful learners of ideas – reflect on the learning actions and strategies they are using to learn the new ideas – review their learning so they can track their learning progress.
LEARNING PHASE 3	The learner reviews and consolidates what they learned – the new idea is encoded in long term memory. The learner can retrieve and apply the new idea. The learner can retrieve the new idea and use it in later learning.
Matching Teaching Practice	Use explicit teaching that guides your students to: – specify their new knowledge about the topic – identify the questions they can answer after learning the new ideas – take their new ideas apart, analyse them, and question them from multiple perspectives – apply the new ideas they have learned in a range of situations – speed up their recall of the new ideas by making links between them and other ideas – suggest how they might use their new knowledge in the future – convert their new ideas into new questions.

QUESTION 10

WHAT'S THE RELATIONSHIP BETWEEN CURIOSITY AND MATURITY?

As young people develop, how they use curiosity can change. The exploratory curiosity of young children is there for all to see. It is 'out there', unaffected by the social context and unselfconscious.

The curiosity displayed by adolescents is different. At this phase of development, peer groups can influence how they display curiosity and the kind of thinking they are prepared to engage.

Curiosity thinking involves taking risks. Adolescents are often less prepared than young children to do this. Being curious about an unfamiliar topic means admitting that what we know about it is insufficient. This admission can be risky. Adolescents often weigh up this admission with the possibility that their peers may see them get something wrong. This can lead them to decide not to engage their curiosity.

Taking risks in class – asking questions, initiating exploratory curiosity – can be adaptive if the student believes the danger of appearing uninformed is outweighed by the benefits of learning more about the topic. The mindset is something like this: if I willingly (IM) accept the challenge and take the risk of stepping beyond what I know, then I may learn more.

IMPLICATIONS FOR TEACHING

The key implication for teaching is that we need to scaffold our students' attitudes to curiosity and learning so that in the classroom, on balance, the conflict between risk taking and maintaining face is minimised and manageable.

Our scaffolding is likely to incorporate those aspects of teaching for curiosity thinking (listed on page 7) which emphasise resilience and capability in social aspects of learning. These aspects include:

- Teach students to link positive emotion with what they learn and know
- Teach students to build a positive identity as curious learners
- Teach a willingness to resolve challenges by taking a risk
- Teach students how to use persistence and determination to maintain focus on learning and thinking goals

QUESTION 11

IS CURIOSITY DANGEROUS TO YOUR LEARNING?

The short answer is 'maybe'.

Contemporary classroom teaching frequently requires students to interpret and use information systems and databases. Search and questioning activities are driven by exploratory curiosity. However, enhanced understanding – or learning – occurs when our students analyse, evaluate and integrate the information they find. Evaluation and synthesis are what drives learning.

Some students, driven by exploratory curiosity, engage more in the search activity than in synthesising the outcomes into new understanding. They need to learn when and how to switch from the exploratory curiosity phase to the evaluation and synthesis phase.

Bowler described the switch in terms of a balance. She notes that some students mis-manage how they use curiosity during the information search process. They may spend excessive effort and time exploring a topic, and spend less in answering the question that launched the search.

They need to learn to regulate their thinking, motivation, and actions by using what they know about how their curiosity works and about the emotions they link with the search. This is their metacognitive knowledge about how (IM) their curiosity works. A key aspect of this metacognitive knowledge is knowing when to replace exploratory curiosity directed at the search topic with intellectual curiosity that motivates the intrinsic desire to learn.

IMPLICATIONS FOR TEACHING

(PE) It is important to spark exploratory curiosity early in learning about a new topic, or embarking on a learning activity related to the topic. Later in the learning, when an information search process is frequently undertaken, teachers may need to assist their students to control (PK) their exploratory curiosity and manage the transition to a focus on intellectual curiosity. This is curiosity thinking that assists them to synthesise information and to form a coherent solution, outcome, or product.

The aspects of teaching for curiosity thinking (listed on page 7) which are most pertinent here include:

- Teach students how to use what they know when they encounter unfamiliar information
- Teach students to meet challenges by framing goals that focus on trying to understand or know more
- Teach in ways that build students' self-confidence or self-efficacy in their capacity to learn
- Teach students how to ask questions about topics that are linked with their learning goals
- Teach students how to draw in new knowledge and understanding by asking questions

QUESTION 12

CURIOSITY AND ALICE: WHERE TO NOW?

In her journey through Wonderland, Alice provides a wonderful example of how to deal with uncertainty and ambiguity. She encounters challenges to her existing world model at every turn. She doesn't ignore them. She takes them on, modeling how to deal with perplexities.

All schools have for their students the goal of learning to think deeply about their world, both creatively and critically. That goal is put within sight when we encourage our students to recognise ambiguities and then act to resolve them. It is made plausible when our teaching enables our students to learn how to respond to challenges to what they know and to learn as a result. It is put within reach when we are precise in our teaching actions, ensuring that our students' learning actions progressively enlarge their capacity for curiosity thinking.

As teachers we can call on many resources that foster exploratory and intellectual curiosity. Twenty-first century technology allows us to offer rabbit holes to every student in every classroom. We can organise the work of classrooms so that peer collaboration taps the gift of collective inquiry. We can develop our professional expertise in using precise models of practice like those described in the *Models of Practice* manuals.

Curiosity can drive powerful learning when our students know how to drive their curiosity. Your teaching actions help them generate that knowledge. And the best time for them to learn how to drive their curiosity is now.

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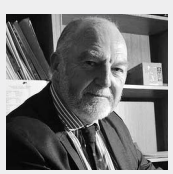

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