



Introduction: Inquiry and Thinking

THE INQUIRY PROCESS AND THINKING

Inquiry learning is not a new concept. The notions of active student involvement in their learning, of learning based on important questions, and of collaboration between teacher and students in pursuing and answering those questions date back at least as far as the work of Socrates.

Many current models of inquiry-based learning exist. They share several common elements, foremost of which are: investigation into a worthy question, issue, problem or concept; a student-centred approach to learning; the discovery and examination of the complexity of understanding and the involvement of thinking and reflection in the learning process. Inquiry-based learning fosters the involvement of students in constructing their own understanding of the complexity of the natural and human-designed world.

Because students are working with new and challenging content and concepts, actively engaged in pursuing and examining complex answers to important questions, and involved in planning, reflecting and evaluating, the inquiry process at once relies upon and helps develop students' thinking processes. It asks them to be critical (or convergent) thinkers, to be creative (or divergent) thinkers and to be reflective (or metacognitive) thinkers.

In terms of critical thinking, an inquiry approach involves all levels of Bloom's Taxonomy, but with a heavy emphasis on the development of higher order thinking skills. Developed in 1956 by Benjamin Bloom *et al*, and revised in 1999 by Lorin Anderson *et al*, Bloom's 'Taxonomy of Educational Objectives' discriminates between levels of cognition, ranging from basic recall to sophisticated modes of thinking that promote complex and high level processing. Now expressed as verbs, the six levels in the model (in ascending order) are:

Remember	recalling and recognising specific information, concepts and ideas in the form in which they are learnt
Understand	grasping the meaning of material, including interpreting, exemplifying, classifying, summarising, inferring, comparing and explaining
Apply	carrying out or using a procedure in a given situation or transferring selected information to a new task
Analyse	breaking material into constituent parts and determining how parts relate to one another and to an overall structure or purpose, including differentiating, organising and attributing
Evaluate	making judgements based on criteria and standards, involving appraisal, checking and critiquing
Create	putting elements together to form a coherent or functional whole; reorganising elements into a new pattern or structure, involving generating, planning and producing.

The inquiry approach also provides significant opportunities for creative thinking, involving all aspects of creativity outlined in William's Taxonomy. Developed in the early 1980s, Frank Williams' 'Taxonomy of Divergent Thinking and Feeling' is, in fact, really two separate taxonomies, with four levels relating to the cognitive or intellectual domain and another four levels related to the behavioural or feeling domain. Williams argued that creative thinking was as much to do with dispositions as it was to do with cognitive processing. The taxonomies related to creative thinking are summarised in the table on the next page (in ascending order).

Cognitive Processes		Affective Processes	
Fluency	enabling the learner to generate a great many ideas, answers, choices, or ways to do something	Risk Taking	involving the learner in trying new challenges, experimenting with new ideas, taking chances or dealing with the unknown
Flexibility	letting the learner find and fit a variety of categories by varying sizes, shapes, quantities, time limits, requirements, objectives, or dimensions	Complexity	permitting the learner to make sense of a complicated idea, create structure in an unstructured setting or build a logical order in a given situation
Originality	enabling the learner to seek new ideas by suggesting unusual twists or by coming up with clever responses to a given situation	Curiosity	encouraging the learner to follow a hunch, question alternatives, ponder outcomes, and wonder about options
Elaboration	helping the learner stretch a topic by expanding, enlarging, enriching, or embellishing possibilities that build on previous thoughts or ideas	Imagination	enabling the learner to visualise possibilities, build images in his or her mind, picture new objects, or wonder about things that do not currently exist

Also embedded in the inquiry approach is a strong focus on and context for metacognitive thinking. This involves knowing what we know and what we don't know, connecting new information to former knowledge, selecting thinking and learning strategies deliberately and planning, monitoring, and evaluating our own thinking processes (Dirkes 1985).

This book, then, is about strategies that require students to use this broad range of thinking capacities within an inquiry-based learning experience. The inquiry model serving as the organising framework for this book was developed by Kath Murdoch *et al* (Murdoch, 1992; Hamston & Murdoch, 1994; Murdoch & Hornsby, 1996; Wilson & Wing Jan, 2003). The model is commonly used across Australia and internationally, and is widely recognised. It is enormously flexible and practical, deeply and thoughtfully based on research into the learning process. Most importantly, it is the model that I have most successfully adopted in my own classroom, and uses terminology which has given my students the most ownership and understanding of their own learning. Over the years, the process has run through a range of iterations, but basically, it involves most or all of the following phases or principles:

Tuning In

- Engaging students in the issue/topic
- Establishing the relevance and/or worth of the topic
- Focusing learners on their prior knowledge and experience of the topic
- Keying teachers into the needs and knowledge level of the learners
- Beginning to identify questions or problems to investigate

Finding Out/Investigating

- Locating and gathering information from a range of sources
- Further clarifying or extending questions
- Challenging students' prior knowledge, beliefs and values
- Providing shared experiences for students to process and reflect upon
- Developing research and information literacy skills

Sorting Out

- Making sense of experiences and data
- Organising information gathered in a range of ways
- Analysing information from a range of perspectives
- Developing understanding of processing tools and strategies

Making Conclusions

- Articulating new understandings
- Developing skills in synthesising and generalising
- Supporting students in understanding at the conceptual level
- Answering and refining questions
- Stimulating newer, deeper questions for independent investigation
- Demonstrating students' progress towards the unit objectives

Going Further

- Alternative experiences or avenues of inquiry to gain new or deeper insights
- Opportunities for individual or small group pathways
- Developing independent research skills

Reflecting and Taking Action

- Doing something with or about what has been learnt
- Considering the bigger picture — what does this mean for me as a learner?
- Celebrating the learning journey

These phases are not some sort of lock-step process to be followed slavishly. Instead, they form a series of elements, most or all of which will tend to inform an inquiry-based unit. The phases of inquiry are eminently flexible: many teachers combine Finding Out and Sorting Out into one stage, while others separate Reflecting from Taking Action. In my own practice, I conceptualise four key phases:

- Preparing for learning (Tuning In)
- Guided inquiry (combining the Finding Out, Sorting Out and Making Conclusions elements into a single phase, providing the background and modelling the processes students might need when working more independently in the next phase)
- Independent inquiry (Going Further)
- Culminating tasks (an opportunity for drawing further conclusions, Reflecting and Taking Action).

The emphasis in modern classrooms on inquiry and student thinking has changed the role of the teacher and provided many new challenges. This book is one of a pair of practical titles responding to these challenges. Using the inquiry process as an organizing framework, this book and its companion *Thinking Tools for the Inquiry Classroom*, present effective tools and strategies for developing students' thinking skills in the middle years classroom (Years 3–9). It contains strategies that stimulate students to infer, analyse, evaluate, decide, create, and reflect. These generic strategies can be applied across the curriculum and can be adapted for use with students of most ages.

Each strategy is presented with a step by step outline of the process, an explanation of when and why a teacher may use it, and some suggested ways to vary, renew or refresh the strategy. Also provided is an example of the strategy in use in a specific classroom on a specific topic – this is not to suggest that the strategy is best used at that level or on that topic – but that these are generic, flexible classroom strategies that will shine at any level and on any topic as teachers breathe life into them and make them their own.



WHAT?

The question dice are two cubes labelled with words that can be combined to form question stems. One die features the words 'Who', 'What', 'Which _____', 'When/Where', 'How' and 'Why'. The other die has the auxiliary verbs 'is (was)', 'does (did)', 'would', 'might', 'will' and 'can (could)'. When the two dice are rolled together, the two words uppermost on the dice can always be combined to form the stem of a question. This is a very useful tool for supporting reluctant or inexperienced students to develop some questions of their own.

HOW?

Students are either given a set of dice or are given a framework to cut and make their own dice. (The dice nets on p 16 are one example of the sort of framework that might be used.)

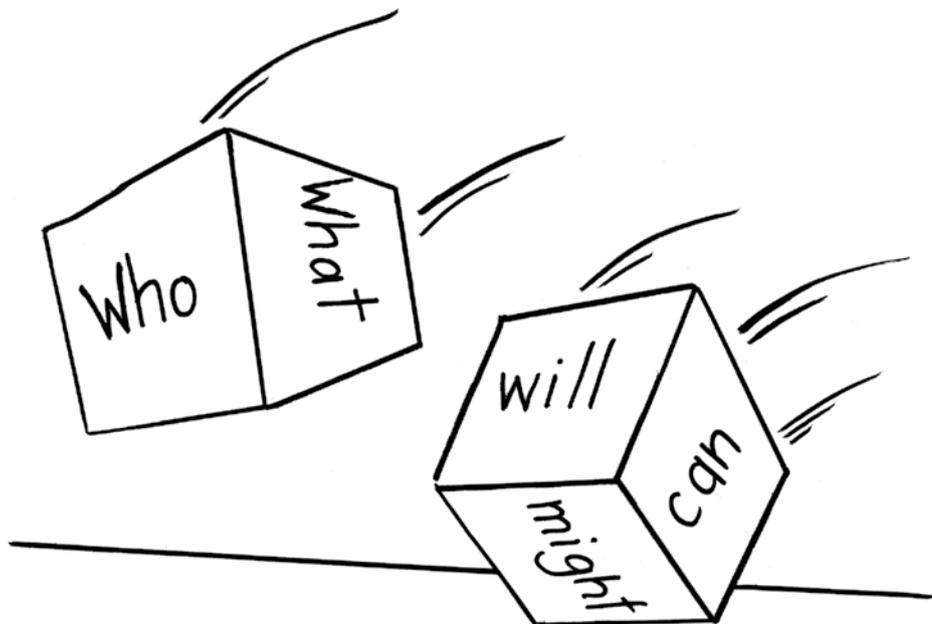
WHEN AND WHY?

The question dice are useful for helping students to generate questions for guided or independent inquiry. They can be used at the Tuning In phase as a way of generating questions that might be used as part of the whole class inquiry or they can be used as a way of developing some questions to provide focus for an individual student's study during the Going Further phase. This is a useful vehicle for developing fluency and is a very safe introduction to risk-taking in students' thinking.

VARIATIONS

For quite young students or students with little command of English, simply using the 'Who, What, Which _____, When/Where, How and Why' die would be a good starting point.

Younger students appreciate much larger dice for this activity. Two ways to provide larger dice would be either enlarging the dice nets or using the bottom of milk cartons to make dice. It is also possible to purchase commercially-made large foam question dice or extremely large dice with inserts.



THE QUESTION DICE IN ACTION

In an inquiry into belief systems at Year 8 level, students were asked to use the question dice to develop some questions that would become the main part of the guided inquiry. The students were organised into groups of three. Each group was given a large sheet of butcher's paper, a set of question dice, and a whiteboard marker.

In the spirit of cooperative learning, each student fulfilled a particular role: one student rolled the dice, another came up with a question based on the words that were rolled and a third student wrote the question on the piece of butcher's paper. The students changed roles after every roll of the dice. After about twenty minutes, all groups' sheets of paper were full and some groups had started on a second sheet. The questions varied in scope from very broad and philosophical to very closed and specific, and related to all levels of Bloom's Taxonomy, as demonstrated by some of the examples below:

- Why do people follow religions?
- How did Buddhism begin?
- Who were the founders of all the different religions?
- What is the biggest religion in the world?
- Why do men have to grow beards in some religions?
- What are the main differences between the main religions in the world?
- What are the main religions in the world?

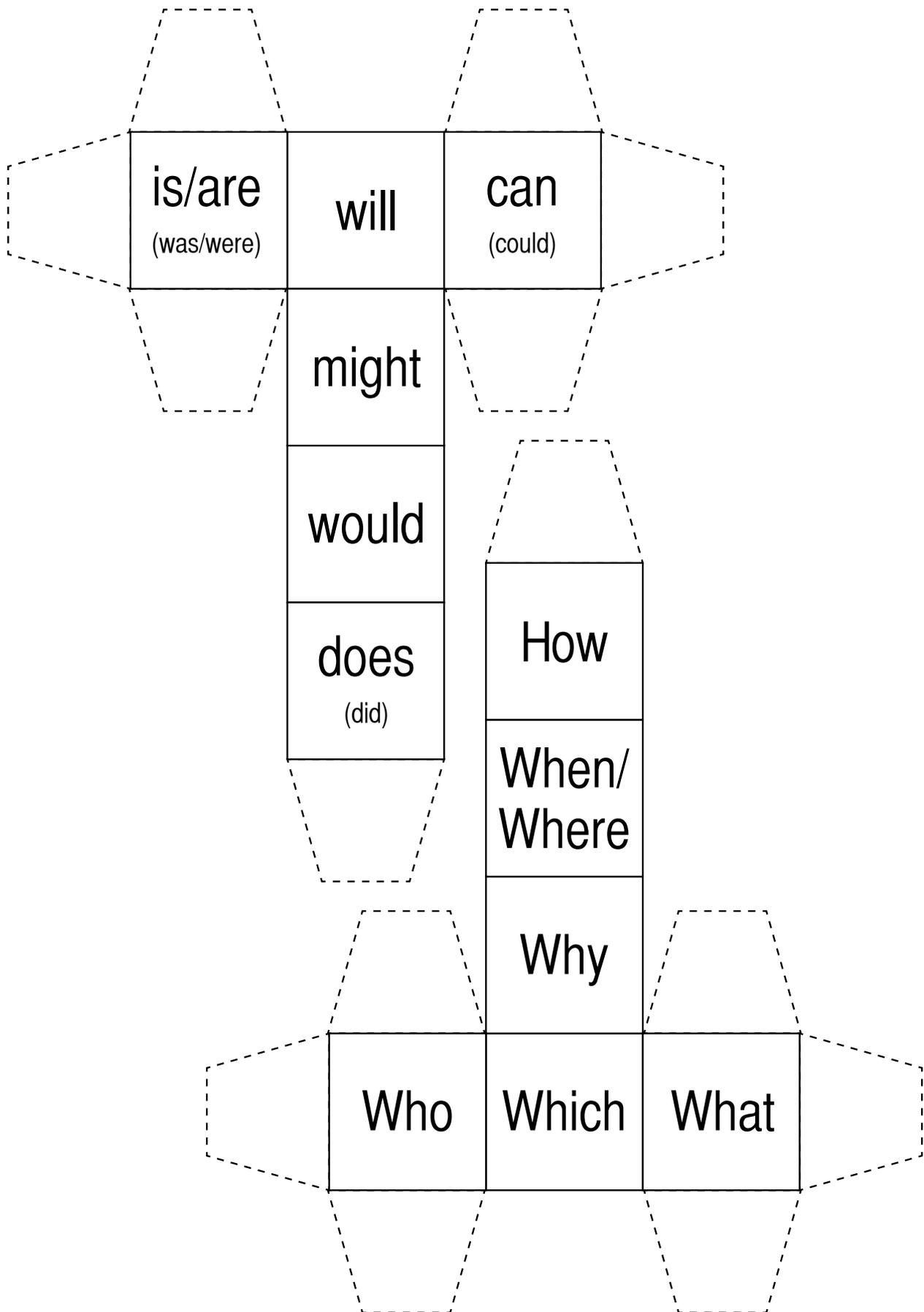
The sheets of paper with the students' questions were displayed on the walls of the classroom and students walked around and looked at the questions.

Each student received six black sticky dots and one red sticky dot, which they used to indicate those questions that they were personally most interested in pursuing. The six black dots were used by each student to indicate their favourite questions – most students spread their dots among four or more questions, giving more than one vote to questions they were particularly keen on. The single red dot, referred to as a 'hot dot' by the teacher, was put next to the question that each student most wanted to work on.

The process provided a very clear message about what questions were of most interest to the students, and these questions were incorporated into the planning for the Finding Out, Sorting Out and Making Conclusions phases of the inquiry.



Dice Nets





WHAT?

This strategy first involves creative or divergent thinking – then, through collaborative processes, some judgement and evaluation. Students are given time to make a list of their top five responses to a question or prompt, and then work with other students to discuss and refine those responses.

HOW?

Students reflect on, and record, their top five responses to a prompt (uses for fractions, reasons for migrating to Australia, ways to stop global warming, rules for an effective learning environment, etc).

The teacher forms students into pairs: they share their personal top five with each other, decide on what they believe to be the five most important or interesting ideas from their combined list of ten and record them – thus creating a shared top five list.

Pairs combine to form groups of four, share their top five lists and decide on what they believe to be the five most important or interesting ideas (or issues) from their combined list of ten. This time they record them on a piece of butcher's paper.

Groups display their lists around the room and circulate in groups from one to another, noting anything they want to discuss or any questions they would like to ask.

WHEN AND WHY?

This is a useful tool for the Making Conclusions phase because students consider and discuss key aspects of an important conceptual understanding. All students think of ideas for themselves when they put together their initial list of top five. This step ensures that all students have a voice in the activity and are required to think and participate. Once they are working in pairs, the number five is an important one: even if students agree to choose two from each of their separate lists, because they are creating a list with an odd number of responses, they will need to make a collaborative decision about at least one item on their combined list.

The top five could also be used to introduce ideas and to stimulate prior knowledge, so it could be a valuable strategy at the Tuning In phase of an inquiry.

VARIATIONS

While reviewing all the lists posted around the room, students could use post-it notes to make relevant comments and raise questions about other groups' ideas. Each group could then be asked to summarise the feedback and address any questions.

THE TOP FIVE IN ACTION

Towards the end of their guided inquiry into leaders and leadership, a Year 5/6 class considered the range of world leaders they had learnt about over the last few weeks and each student made a list of his or her top five world leaders (in no particular order). The students were given some time to enable them to think through their responses.

The students were then paired up randomly, prompted to share their list with their partner and explain their reasoning for each choice. After each student had discussed his or her choices, the teacher asked each pair to come up with an agreed list of top five world leaders (again, in no particular order).

The teacher arranged the pairs into groups of four and the process was repeated until each group ended up with an agreed list of five world leaders. Groups wrote their lists onto large sheets of butcher's paper, following the teacher's instruction to leave a 15cm space under each of the five names on the list.

The teacher then asked the class to consider some of the qualities they thought made a great leader. The students had many suggestions, because the top five discussions had started them thinking about these ideas from the start of the lesson. The teacher recorded suggestions on the whiteboard and then went over this list of qualities with the class to remove any redundancies and provide opportunity for disagreements to be raised.

Returning to their butcher's paper, the groups of four used a different coloured whiteboard marker to write under each of the names on their list the appropriate leadership qualities from the class list on the whiteboard.



At the end of the process, each group put their sheet of paper up on the wall. In their groups, they walked around the room looking at and discussing other groups' ideas. The teacher insisted that each group come up with at least one question based on what they saw on the other sheets and these questions became the basis of a class discussion on the concept of leadership.