

Designing a Thinking Curriculum

Edited by Susan Wilks

Revised edition



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Preface

With the emergence and popularity of the term ‘thinking curriculum’ there is an urgent need for teachers to understand what this means and consider ways of changing their classrooms into appropriate learning environments. In this text teachers describe how they have been influenced by theorists, their use of appropriate cognitive theories, and strategies they have developed for scaffolding and constructing approaches to learning that will assist their students to develop higher order thinking skills. Ways of accommodating a variety of learning styles and establishing supportive school structures are also presented.

This text is intended to provide teachers, curriculum coordinators and administrators with interesting background to, and ideas for, the implementation of a thinking curriculum in their schools. It contains chapters written by teachers, teacher educators and curriculum consultants that concentrate on issues connected with reforming education today.

Curricula designed by teachers who have built higher order thinking into their programs are featured. Their innovative curriculum content has been designed as a response to the problems of the middle years and the education of adolescents and beyond. Each teacher has based his or her curriculum on the needs of their students.

Synopsis

Editor's introduction

A background to the emergence of the thinking curriculum, its role in the development of higher order thinking, and ways of establishing appropriate structures and environments.

01

Background to thinking curricula: theories concerning thought and language

In this chapter Wilks examines theories and practices that have contributed to the development of thinking curricula, many of which are still influencing teachers as they establish appropriate environments and find thinking tools that suit their classrooms.

02

Developing an effective classroom climate for higher order thinking

The contribution made by the Community of Inquiry model as a means of creating an appropriate environment for a thinking curriculum is described by Abbott and Wilks. This approach is integrally linked with reading, discussing and seeing. It describes how, through the fostering of critical and reflective thinking skills, teachers can assist their students to become fully engaged using these three areas. The chapter ends with an exemplary model of a thinking-based curriculum. Rex Brown, author of *Schools of Thought*, 1993, and founder of PS1, a Charter School in Denver, Colorado has developed a curriculum that emphasises engagement.

03

Creating a thinking school

Golding describes the conditions necessary for a thinking curriculum to become a reality. He argues for authentic learning and assessment, explicit reference to the thinking curriculum at all levels, and involvement of the whole school community. Golding has also included a Thinking School's Checklist.

Using a thinking curriculum to guide learning in the middle years

As Thinking Oriented Curriculum (TOC) and Special Programs Coordinator, it is Meath's role to support teachers as they infuse thinking skills into their programs. She assists curriculum leaders, year level coordinators, and team leaders to address thinking skills from Years 7–12. In this chapter she describes what she believes are the important theoretical underpinnings of an effective thinking curriculum, always keeping in mind the needs of students at both classroom and whole school levels. She demonstrates what Queensland's New Basics Project and other models offer the thinking curriculum and has infused the thinking curriculum into a Materials Technology unit.

Testing everyone?

If we examined the activities and assessment tasks we set for our students, many of us would find we undervalue the students who are skilled in domains other than the verbal and mathematical. In this chapter examples of attempts to test visual literacy are discussed by Wilks. Some existing restrictive and/or flawed test questions are examined, and simple changes and some new examples are suggested. A discussion of the benefits of authentic assessment follows.

The visual arts as a thinking tool

In this chapter Wilks demonstrates how the visual arts and issues raised by examining artworks can be used by teachers in all learning areas to promote flexible thinking skills and problem solving strategies. The examination of artworks can also foster the examination of the complex relationships that exist between people, cultures and artefacts. The theories and approaches of Perkins (1994) and Lipman (various) are included. Examples of strategies and resources that can be used to engage students and develop their analytical, conceptual and perceptual skills and understandings through the visual arts are provided.

Developing a thinking curriculum for Year 5: theory and practice

Pietzner discusses the theories behind his Year 5 thinking curriculum. He examines Anderson's revision of Bloom's Cognitive Taxonomy and then shows how he has distilled this, Gardner's Multiple Intelligence theory and Lipman's Philosophy for Children model into the Three Storey Intellect model (Gathering/Processing/Applying). He has used Queensland's New Basics Productive Pedagogies model to evaluate his unit of work, the product of which is included.

Negotiating a thinking skills curriculum in Year 8

This chapter articulates a curriculum plan Reynolds devised to draw together various approaches used to promote higher order thinking within a theoretical framework. The need to develop a unit for his Year 8 Society and Environment and English classes provided him with an authentic purpose and considerable motivation. The planning of this unit occurred as a collaborative process (with McArthur) of assessing theoretical principles, identifying the needs of the students, establishing key conceptual goals for student learning, and writing appropriate assessment criteria.

Designing a thinking curriculum for later middle years' adolescents

Bawden focuses on a range of learning and brain science theories about how students learn and contexts for learning. He examines the implications for curriculum organisation and appropriate pedagogies for adolescents in later-middle years (7–9). Using a multi-disciplinary approach around the theme of 'Conflict' to encourage higher-level thinking skills, both learning approaches and authentic assessment are described. He has also included opportunities for students to reflect on their understandings.

Valuing and assessing higher order thinking skills in mathematics

The reality of what is happening in mathematics classrooms need not be limited to closed work practices. Hoskins describes a number of stimulating activities that improved student thinking in her middle years' mathematics classroom. The class undertook practical explorations of trigonometric relationships, played fraction and decimal games with chocolates, explored the mathematics in cake recipes and much more. Approaches and understandings gleaned from Herrmann's brain theory for processing information and Ely and Caygill's categories for assessment caused Hoskins to concentrate more on her students' thinking styles and reconsider assessment tasks.

Creating a design and multimedia thinking curriculum

Chenery has created a design and multimedia thinking curriculum primarily modelled on Gardner's Multiple Intelligences. As a career or vocation, multimedia and design are major growth areas. Ultimately the successful practitioners in these areas will be well grounded not only in technical skills, but also in the ability to think creatively and maintain an interest and curiosity in the big questions. Chenery believes that learning how to learn is the key.

Identifying and assessing a thinking-based design curriculum

Saddington, a graphic design teacher, believes the function of design in society is too important to be driven by industry and information technology. The curriculum he proposes is based on a combination of Queensland's New Basics curriculum, Atkin's Integral Mind theory, and the Illinois Institute of Technology's research and development models. The basis of his curriculum model is a triad of concepts, multi-level projects and research and development methods replacing the traditional outcomes-based project modules.

Editor's introduction

Today we are challenged to not just be knowledgeable but to address deeper questions through critical analysis. We are told we need to be able to innovate, problem solve and consider issues from multiple perspectives. But how do we teach these skills as well as a tolerance for diversity and the understanding of complex ethical issues, while at the same time encouraging optimal use of new technologies? How do we achieve all this and keep our students engaged in their learning? Rapidly expanding thinking curriculum theories and middle years' research are offering appropriate ways of improving programs and maintaining student engagement.

This text is intended to provide primary and secondary teachers, curriculum coordinators and administrators with an interesting background to, and practical activities for, the implementation of a thinking curriculum in their schools. It contains teachers' discussions of issues connected with reforming education today. Curricula designed by teachers who have already managed to build higher order thinking into their programs are featured. Their innovative curriculum content has been designed as a response to the problems of the middle years and the education of adolescents and beyond. Each teacher has based his or her curriculum on the needs of their student cohort. This includes:

- the need to develop a positive self-concept and sense of identity,
- the importance of examining personal and social values, and
- the ability to respond constructively to the world around them.

They have also considered the students' need to be engaged in, and challenged by, their education and to experience social acceptance and affection among peers and adults.

In order to sustain the engagement of their students, the teachers have sought approaches, opportunities and experiences that are grounded in the students' social context and that involve them in 'big ideas', through 'rich tasks' and

‘authentic assessment’¹ while also challenging their cognitive capacities. Each writer describes their personal philosophy and the theories, strategies and tools of the theorists who have influenced their curriculum design.

The importance of developing a classroom environment that supports the students as critical thinkers is a common theme in this text. The teacher’s role is viewed in most instances as the promoter of thinking and learning.

The writers have tried to ensure there are opportunities for students to use their preferred learning styles and dispositions to promote engagement and effective communication of ideas and information. Recognising the needs of adolescents, they have created opportunities for individual and collaborative and negotiated learning and assessment tasks.

The teachers demonstrate how higher order thinking is encouraged through the use of scaffolding and appropriate strategies and thinking tools. Many have modelled their curricula around ideas and issues generated by the students. They demonstrate how they have linked real problems to curriculum content. They have sought ways of ensuring that students achieve deep knowledge and understanding. Many emphasise the importance of problem-based curricula and demonstrate how Bloom’s and Gardner’s theories have assisted their planning structure. Some demonstrate how they fostered higher order thinking through the use of technology, creative thinking, the visual arts and mathematical and scientific ideas.

The teaching and learning strategies they have commonly employed are:

- philosophical inquiry with its emphasis on reflection and metacognition,
- using students’ questions as the basis of inquiry,
- developing respect for others’ ideas, and
- teacher questioning which probes the underlying structure of thinking and assists the making of reasonable judgments.

Background to the thinking curriculum

The mapping of student learning across the compulsory years of schooling (Hill & Russell, 1999) revealed what many practitioners had suspected. There was virtually no growth during the middle years of schooling (Years 5–8) in reading, writing, speaking and listening.

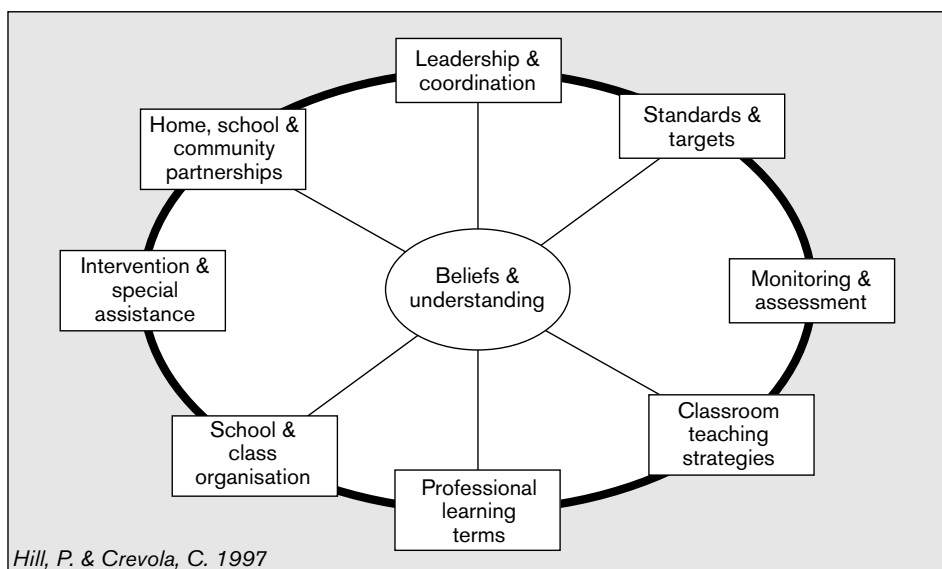
¹ These terms first came to my attention through Education Queensland’s New Basics Technical Paper in 2000. The New Basics Curriculum describes ‘Productive Pedagogies’ and ‘Authentic Assessment’ through ‘Rich Tasks’. It provides valuable tools for the development of thinking curricula units. <http://education.qld.gov.au/corporate/newbasics>

They discovered a disengagement of students, either actively or passively, and described it as alienation. Since that time many administrations, researchers and teachers have worked to reform the middle years of schooling, many originating in the projects that followed the Middle Years Reform and Development (MYRAD) report.

The lack of student engagement during the middle years provided the impetus to introduce students to the Thinking Oriented Curriculum (TOC). But what does this mean? How are thinking curricula being implemented? To what extent are school administrators and communities involved? Can teachers adapt the existing curricula in their classrooms? What issues need to be understood and resolved?

The diagram below demonstrates the scope of systematic reform believed necessary to properly address the needs of students in the middle years.

Design of a whole school approach to effective teaching



(Source: Department of Education, Employment and Training, Victoria, 1999, *The Middle Years—A Guide for Strategic Action in Years 5–9*, Australia, p. 20)

If we are serious about providing instruction that reflects a concern for learners and a willingness to adjust the learning environment to meet the needs of individuals, then we need to establish:

- structures that enable teachers to know their students well and work with them intensively, such as teacher teams that support collaboration focused on student learning,
- ways of making it clear that the school values how the students are faring, for example, through performances and exhibitions of student work, and

- opportunities for shared decision making and dialogue about teaching and learning with the whole school community (Keefe & Jenkins, 2002).

Teenagers, particularly, need close relationships rather than large impersonal schools, and they need opportunities to experience increasing autonomy.

Creating a learning environment for the thinking curriculum

Constructivism, with its emphasis on learner-constructed knowledge, underlies most unit and/or curriculum designs in this text. Using this approach teachers are aiming to create learning communities in which students confront big ideas and apply their learning to meaningful real-life experiences.

In a classroom exhibiting a constructivist framework, reflective dialogue and the time needed for it to occur, problem solving, and student initiative are all valued. Teachers take on a role that is more like a teacher-coach as they work with their students to improve their cognitive skills—seminars and long-term projects are preferred ways of working. Small collaborative groups encourage collaboration and socialisation and gains in achievement are common (Slavin, 1991). Classroom layouts that enable students to face each other as they work together are essential. Examples of successful interactive environments include inter-disciplinary teaching teams, smaller school-within-school units, and common planning times for staff.

A classroom that is a thinking environment will exhibit the following:

- longer periods of time that allow investigation and interactive dialogue,
- big topics and authentic tasks that are of interest to the students and are investigated with coherence and over long periods of time,
- challenges that require the students to produce new knowledge,
- emphasis on problem posing, reasoning, self-correction and a willingness to admit errors and seek explanations, and
- the use of accurate vocabulary that describes what is occurring, for example, making predictions, questioning inferences, and posing hypotheses.

School structures

Teachers today are feeling the pressure to say they are implementing Thinking Curricula. The reality is that few have employed a systematic package that covers all aspects of education. Some schools are exploring what it will mean across the board. The changes to timetables, teaching models and curricula are significant.

The commonly used thinking skills models, for example Anderson, Bloom, de Bono, Gardner, Lipman, and sometimes Perkins, are providing tools that are frequently being used with little understanding. There is a need for teachers to read and understand the basis of these theorists' tools, not just try to add them to their teaching repertoire after a quick professional development session.

It is also helpful for teachers to understand both their students and their own preferred ways of operating. Do they know the 'intelligence/s' they mainly foster through classroom activities, for example, linguistic, visual, scientific (Gardner, Pohl), or the brain quadrant in which they mostly operate (for example, Atkin, Herrmann)? They need this knowledge in order to check for bias in terms of the strategies they normally use in their classroom.

School staffs also need to work together to implement a thinking curriculum that takes into account their particular setting. They need to address major issues, such as: What should we change? How can we implement a thinking curriculum within our already overcrowded curricula? What changes would need to be made to timetabling? Could we establish interdisciplinary team teaching? What extra resources are required to ensure a holistic and coherent curriculum is created? What targets do we need to set to achieve our aims realistically? How will we know if we have achieved our goals?

The teachers whose work appears in this text describe how they have addressed these issues as they developed their thinking curricula models.

Devising or revising a curriculum

Consideration should be given to all dimensions of the learning process such as age, subjects, the classroom/studio environment and the community.

Chenery's model, below, offers an approach staff could follow when devising a new (or revising an existing) curriculum (see also Chapter 10).

Identify problems	Analyse the existing situation and identify flaws, inconsistencies. Look at results, retention rates, feedback from students, parents, teachers, administrative staff.
Devise strategies	Plan methods to solve these problems using discussion groups (all parties).
Research	Utilise research methods from successful faculties/schools. Bring in experts (with evidence of success) to speak to staff and students—for example Queensland's New Basics Project. Join a curriculum development group, share information with other faculties/campuses.
Planning	Revise existing framework or develop a new framework. Set a time frame for developing strategies and implementation.
Details	Set examples and use staff, student and parental input to develop the curriculum topics, questions, rich tasks, and methods for analysing results. Expectations of outcomes should be established at this stage to establish an initial benchmark for future analysis and evaluation.
Establish curriculum	Develop a written curriculum and establish the assessment criteria. A review process should be established to measure improvements, problems and outcomes.

In Chapters 3 and 4 Golding and Meath provide guidelines for schools wishing to establish a thinking curriculum.

Learning styles

The importance of understanding students' learning styles is gaining popularity. There is now a range of learning style assessment measures (for example Gardner and Herrmann) that helps teachers identify students' strengths and weaknesses and organise their instruction accordingly. This information can be used to define the areas in which a student is both likely and unlikely to succeed and provides a good starting point for subsequent learning tasks.

The three broad categories used by Bloom et al. to identify learning styles were:

- **Cognitive styles**—preferred ways of perception, organisation and retention of information—for example, whether they prefer auditory, visual or psychomotor learning.
- **Affective styles**—associated with emotion valuing and personal motivational approaches.
- **Physiological styles**—traits associated with gender, health, and response to the physical environment.

Successful thinking curriculum development will depend on many considerations apart from the theoretical model one chooses. Well-constructed curriculum plans will include:

- consultation with stakeholders including teachers, the school committee, parents and the student body,
- revisiting the goals and mission of the school's educational philosophy,
- the purpose and required outcomes of the thinking curriculum,
- an understanding of relevant demographics in order to establish whether course/subject guidelines need to be tailored to circumstances, and
- an organisational and structural plan.

A consideration of these areas forms the background to the content of this text.

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Facing Each Other

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Background to thinking curricula: theories concerning thought and language

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Abstract

If teachers want their students to think carefully and critically about issues as well as express their ideas, then they need to provide an appropriate context. This includes, first, the recognition that all students are capable of inquiring into abstract ideas and improving their thinking, second, the provision of appropriate resources that stimulate higher order thinking and inquiry, and third, the establishment of a classroom environment that fosters the exploration of beliefs and values associated with the content of these resources.

This chapter examines some of the theories and practices that are influencing teachers as they endeavour to establish appropriate environments, foster thinking skills and thinking classrooms.

Introduction

Thinking is integrally linked with reading, discussing, feeling and seeing. Each of these activities can re-acquaint students with experiences as well as introduce new concepts and ideas. Although inquiry is a part of every curriculum area, it is only through the fostering of critical and reflective thinking skills that teachers can assist their students to become fully engaged cognitively, affectively and physically. Using students' experiences provides a starting point for better inquiry.

Today, you are less likely to see teachers standing out the front of their classrooms talking at students who are sitting in rows of desks. But, if you see this classroom set-up, then it is fair to make the assumption that the teachers are probably 'teaching themselves'.

Obviously a certain amount of direct instruction must occur in classrooms, for example explaining, demonstrating and informing, but teachers need to create an environment that fosters the kind of classroom dialogue that leads to improvements in cognitive and effective levels of student thinking and understanding.

Teachers influence the level of their students' thinking through the nature of their classroom discussions and tasks. They generally achieve what they seek from their students, so when they try to extend students to higher levels of thought, the students usually respond. The degree of student participation in discussions is related to the level of student engagement and self-esteem, the extent to which teachers respond to students' ideas and ask questions that increase the levels of abstraction of inquiry, and how much encouragement is given to students to question ideas and issues.

There is a world of difference between knowledge-based approaches and curricula developed to teach big ideas and promote conceptual understanding. Although the active and discourse-centred modes of teaching place demands on both teacher and student, teachers are recognising their value and are finding ways to incorporate them.

Beliefs about the role of language in developing thinking skills

Vygotsky

Vygotsky (1962) claimed that while Piaget believed that a child's thinking went through stages, regardless of any instruction received, the gauge of the child's level of development was not what had been learned through instruction, but the manner of thinking about unfamiliar subjects. He believed that 'directed' thought was essentially a social process that needed to be conscious, adapted to reality, susceptible to truth and error, and communicated through language. Vygotsky emphasised the importance of both teacher–student and student–peer interaction in the learning process. Importantly, he stressed that students performed at higher intellectual levels than otherwise expected when in collaborative situations.

The major relevant factors in Vygotsky's theory for this text are the requirement that teachers actively encourage learning through concept formation and the importance of the spoken word. Vygotsky believed that if the environment made no new demand on students, presented no problems requiring the formation of concepts, and did not stimulate the intellect by providing a sequence of new goals, then either their thinking would not reach the higher cognitive stages, or it would be delayed. From the 1980s, concerns about literacy standards tended to be led by writers in the United States. It was usually connected with catch cries like 'creating a clever country' or 'surviving in a competitive global economy'.

An unfortunate outcome of the above was the over-emphasis on testing. However, the call for restructure in education was also responsible for an

increased focus on ‘process’ in the study of intelligence by cognitive psychologists. They argued that whether or not Piaget’s notion of developmental stages and progress through them was accepted, the distinction between concrete and formal operations was educationally significant because many adolescents had not acquired the ability to engage in formal (abstract) thinking. They had simply not been extended to unfamiliar domains.

Bloom

Bloom’s hierarchy of thinking defined higher and lower order thinking and described differences between concepts such as knowledge and comprehension. Perhaps because Bloom’s taxonomy has commonly been interpreted as sequential, and because Piaget stressed that concrete rather than abstract thinking occurred in the early years of childhood, teachers may not have encouraged young students to explore reasons, think abstractly, or express their own ideas. Theorists in the late 1980s were beginning to advocate the teaching of lower and higher order thinking skills at the same time. This challenged teachers to understand that thinking is a process and not a product. The hierarchical view of thinking can be replaced with the alternate belief that thinking is creative, complex and critical (Lipman, 1990). The cognitive domain of Bloom’s Taxonomy of Educational Objectives (1956) is used today as a basis for making distinctions between lower level and higher level thinking evident in classroom discussions and activities. Using the Taxonomy as a guide, many studies have shown that too much teaching that is concerned with facts and knowledge occurs at the lower-level of Bloom’s scale. Bloom’s Cognitive Taxonomy was later revised by Anderson and a team of cognitive psychologists (Pohl, 2000). The taxonomy, along with Anderson’s revision, is summarised below.

Achieving proficiency at the higher levels of the cognitive taxonomy means that a student who can analyse information and apply it in new situations will better adapt to a new and changing world, as will those students adept in making reasoned judgments and creating new ideas.

Bloom’s Cognitive Taxonomy and Anderson’s Revised Categories

<i>Bloom’s Taxonomy</i>	<i>Anderson’s Revision</i>	<i>Description of Categories</i>
Knowledge (recall of information)	Remembering	Recalling information.
Comprehension (to show understanding of information)	Understanding	Explaining ideas or concepts.
Application (to use previously learned information in a new situation)	Applying	Using new knowledge in another familiar situation.
Analysis (to break information into parts to explore understandings and relationships)	Analysing	Differentiating between constituent parts.

Synthesis (to put together ideas in a new way or develop new products)	Evaluating	Justifying a decision or course of action.
Evaluating (to judge the value of materials or ideas on the basis of set criteria)	Creating	Generating new products, ideas or ways of viewing things.

Bloom's Affective Taxonomy

The Affective Taxonomy developed by Bloom and associates alongside the cognitive taxonomy, has not yet attracted the attention of curriculum developers. However, it deserves a mention as it has relevance for the social, ethical and philosophical dimensions of a classroom. The following descriptors have been adapted from Krathwohl, Bloom, and Masia (1956). The Affective Taxonomy (below) was developed to organise levels of commitment and could be regarded as a regulatory system.

- **Receiving:** Being aware of or attending to something in the environment.
Example: An individual listens to a lecture or presentation related to a model of human behaviour.
- **Responding:** Showing some new behaviours as a result of experience
Example: The individual answers questions about the presentation of the model or re-writes lecture notes the next day.
- **Valuing:** Showing some definite involvement or commitment.
Example: An individual begins to think how education may be modified to take advantage of some of the concepts presented in the model and perhaps generates lessons using the concepts presented.
- **Organisation:** The individual integrates a new value into a general set of values, giving it some ranking among his or her general priorities.
Example: This is the level at which a person would begin to make long-range commitments to arranging his or her instruction and assessment relative to the model.
- **Characterisation by value:** Acting consistently with the new value.
Example: At this highest level, a person would be firmly committed to utilising the model to develop, select, or arrange instruction and would become known for that action.

Another model, Williams' Taxonomy (in Pohl, 2000), is explicitly directed towards creative enquiry. Williams' categories are Fluency, Flexibility, Originality,

Elaboration, Risk-taking, Complexity, Curiosity and Imagination. Teachers are encouraged to offer activities that stimulate these modes of thinking.

To Williams' model it is useful to add three other categories. These are specifically relevant for theories for the middle years and concern the authenticity of activities and assessment. They are: Persistence, Effectiveness and Presentation.

- **Persistence**—encourages the learner to declare a concept 'finished' only reluctantly, remain constantly open to further possibilities, and make conceptual links beyond a current project to subsequent ideas and/or projects.
- **Effectiveness**—encourages the learner to seek ways of measuring the communication value of their creation to an external audience.
- **Presentation**—encourages the learner to seek out the most effective expression of a concept or an external body of information. (Source: Saddington, see Chapter 12)

Immersion

In 1971, Cambourne placed microphones on students in both school and home settings and found, interestingly, that school settings generated shorter and less complex sentences than home settings. This was because in school questions were less likely to be contingent on a child's line of thought than in their home. This helped explain why young children were more involved and loquacious at home. Although mainly involved in researching the teaching of reading, Cambourne formulated eight conditions that he believed were vital for learning. Immersion was the most important. It is useful to recall these conditions and apply them to learning in general.

- **Immersion**—in all kinds of media, for example, art works and literature.
- **Demonstration**—learners should be exposed to many models.
- **Expectation**—learners are more likely to engage if teachers have high expectations.
- **Engagement**—understanding is best fostered by a non-threatening environment.
- **Responsibility**—learners need to decide when, how and what to learn.
- **Use**—time and opportunity are required to practise new skills in realistic ways.

- **Approximation**—learners must learn to take risks—‘mistakes’ are essential.
- **Response**—feedback must be relevant, timely and non-threatening.

Advocates of the immersion approach place a high premium on dialogue during learning. In this approach, students’ ways of representing ideas must be taken seriously by their teachers. The dilemma for teachers is how to foster the students’ efforts to seek meaning. The view that ideas, as opposed to skills and processes, should be assigned the highest priority in promoting thought and understanding in the classroom is gaining support. There is also general agreement that discourse plays a key role. In the 1970s when Cambourne was active, Matthew Lipman’s philosophical inquiry model (see later in this chapter) was establishing a method that would assist teachers to encourage discussions and thus foster students’ ideas.

The mid-1980s

Bruner (1985) believed that language was not only a medium for exchange but also an instrument for the learner to bring order into his or her environment. He believed that an adult and/or peers served the learner as ‘scaffolding’, until the learner was able to independently control a new function or concept.

Nickerson, Perkins and Smith (1985) believed that thinking skills, like motor skills, could be taught, practised and learned. They concluded that most people had the potential to develop far more effective thinking skills than was occurring. They also noted that while the ability to reason and solve problems via analysis and deduction was generally correlated with intelligence, high intelligence did not guarantee creativity. They believed that certain cognitive styles, for instance, a disposition towards problem finding and deferring judgment, bore a relation to creativity. They further claimed creative people valued and sought originality and, consequently, instruction should foster all these attributes together with a questioning attitude. This would not occur if the students were not engaged.

The 1990s

In the 1990s teachers were struggling to find methods of dealing with the requirement that they involve students in discussions (not to mention postmodern and post-structuralist perspectives). Lipman’s community of inquiry model for classroom discussion (described later in this chapter) provided an appropriate forum for critical thinking. Its use of questions, asked from the time of Aristotle onwards, about aesthetics, language, ethics, epistemology and logic, satisfied the narrative which Bruner espoused (Haynes, 1991).

Gardner

Howard Gardner (1997) stated that teachers can only know whether their students understand by asking them to perform what they understand, a process

that requires both time and feedback. He rejected the prevalent emphasis on ‘back to basics’ and ‘outcomes’ influencing educators in the US in the late 1990s. Stressing that understanding the notion of multiple intelligences was a means and not an end. He cited as obstacles to understanding, the acceptance of short answers, text context, emphasis on correct answers and pressure on coverage. The educational approaches that enhanced learning were, according to Gardner:

- asking big questions and involvement in enduring issues,
- focusing on rich generative ideas and topics,
- a knowledge of students’ preferences for understanding, and
- contextualised assessment.

These factors are the central tenets of middle years’ theories at the beginning of the 21st century.

In 1997 Gardner described six entry points to big questions and rich ideas: narratives, numerical (quantitative) concepts, foundational questions, aesthetics, hands-on activities (as in children’s museums), and cooperative learning. He believed aesthetic inquiry was useful for getting to a core issue and catered for varying styles and rates of development. He advocated the use of art as an entry point to moments in time. Creativity in any field was, according to Gardner, high level achievement in an original way.

Gardner’s theory of Multiple Intelligences (MI) grew from his early research into the functioning of the brain. Teachers who are implementing thinking curricula are using grids like the table below as a way of recognising and developing their students’ learning styles.

<i>Gardner’s Intelligences</i>	<i>Characteristics</i>
Logical/mathematical	Sensitivity to logical or numerical patterns and ability to handle long chains of reasoning.
Linguistic	Sensitivity to sounds and meanings of words and the different functions of words.
Musical	Ability to appreciate rhythm and pitch and musical expressiveness.
Spatial	Capacity to perceive the visual spatial world accurately.
Bodily/Kinaesthetic	Ability to control one’s movements accurately.
Interpersonal	Capacity to understand and respond to other people appropriately.
Intrapersonal	Access and understanding of one’s own feelings, abilities and desires in order to guide behaviour.
Naturalist	Ability to discern, comprehend and appreciate flora, fauna, species, animal behaviour, use of resources and geography.

Examples of the application of Bloom's Taxonomy and Gardner's Multiple Intelligences to a thinking curriculum are applied in Pietzner (Chapter 7) and Chenery (Chapter 11). Teachers also find it useful to consider David Lazear's (1999) definitions and applications of the MI (see below).

By the 1990s, the teaching of metacognitive skills, that is, thinking about thinking, was an important focus of a group of American learning theorists to whom practicing teachers around the globe were gaining access. Leading international theorists like Gardner, Costa, Feuerstein, Perkins, and de Bono were regularly delivering papers at Australian 'Thinking' conferences for teachers. Teacher educators who had adapted the above-named theories into practical classroom activities were presenting at the same conferences (for example Fogarty, and Lazear).

<i>Gardner's Intelligence</i>	<i>Lazear's Exemplars</i>
Verbal/linguistic The production of language: poetry, storytelling, debates, etc.	Poets, playwrights, storytellers, novelists, presenters, public speakers, and comedians.
Visual/Spatial Sight and visualisation: visual arts, architecture.	Artists, architects, industrial designers, navigators, map-makers, cartographers, surgeons, and chess players.
Logical/Mathematical Scientific or inductive reasoning, able to recognise patterns and connections.	Scientists, mathematicians, computer programmers, accountants, lawyers and bankers.
Bodily/Kinaesthetic Use of the body to express emotion, play a game, ride a bike, and park a car.	Actors, athletes, dancers, mimics, and inventors.
Musical/Rhythmic Recognition of rhythmic and tonal patterns, natural and musical sounds.	Composers, musicians, and sensitivity to singers.
Intrapersonal Knowledge of the self, feelings, emotional responses, thinking processes and reflection. Have an objective view of the self, perceive higher states of consciousness, dreams and planning.	Philosophers, psychiatrists, and spiritual counsellors.
Interpersonal Ability to work cooperatively with others, skilled verbal and non-verbal communication, able to detect moods, temperament, motivations and empathy.	Counsellors, teachers, therapists, politicians, and religious leaders.
Naturalist Ability to discern, comprehend and appreciate flora, fauna, species, animal behaviour, use of natural resources, geography.	Biologists, farmers, zoologists, gardeners, cooks, veterinarians, national park rangers, and nature guides.

Philosophy for children: the community of inquiry model

The teaching of thinking skills is the result of the belief that intelligence and thinking ability can be modified. This is in contrast to the view that the purpose of education is to provide students with a great deal of information and that those with intelligence will assimilate it and those without it, will not. Lipman, Sharp and Oscanyan (1980) were concerned that teachers they had observed did not encourage student learners to think for themselves, form independent judgments, or be proud about having their own insights and points of view.

Lipman et al. shared two fundamental notions with Piaget—the value of constructivism and the idea of the social origins of reasoning skills. They claimed that young children constructed meanings, they were not given them, nor did they discover them already formed within themselves. Donaldson (1984) supported this view stressing that very young children learned to reason when they had a motive to do so in order to escape their egocentrism. A crucial element of Lipman's theory was his belief that a sense of wonder on the part of both the teacher and students was a key to inquiry that led, in turn, to critical thinking (1990).

Lipman (1990) believed that young children developed language skills by listening to adult conversations, identifying with the speakers, internalising their linguistic behaviours, and simultaneously grasping the logical and syntactic structure of the language they employ. He referred specifically to children's ability to be philosophically creative, a point he believed had been well established by Howard Gardner.

Philosophical traditions influenced Lipman as he sought to make his undergraduate philosophy classes meaningful. From Peirce's notion that scientists belonged to a 'community of inquirers' and as such should share discoveries and information, Lipman took the descriptor 'community of inquiry' for his teaching approach. In Dewey's writings, Lipman found pedagogy for converting classrooms into communities of inquiry. Influenced by Dewey's insistence on the importance of experience in learning, he created stories with problematic situations that raised questions about philosophical issues and required the use of philosophical skills.

In 1990, Lipman described the three major beliefs underpinning his Philosophy for Children curriculum. They were, first, a belief that thinking skills could be improved by giving students the opportunity to practise the skills of philosophical inquiry; second, the importance of providing an effective curriculum; and third, ensuring the curriculum was intellectually challenging and stimulating. He believed the 'give-and-take' of the community of inquiry approach led to student understanding. This occurred when, with the teacher as guide, students sought to make sense of the problems presented to them. The diversity of class members' ideas and values became obvious through this approach.

Australian research into the effectiveness of Lipman's philosophical inquiry approach (Wilks, 1992, 2000; Sprod, 1994; Milvain, 1995) established that appropriately conducted discussions of complex issues affecting students' daily life led to three clear outcomes:

- the examination of deeper and broader meanings,
- abstract meaning resulted from examining concrete examples, and
- higher order deliberation of 'big' issues.

These are the outcomes being sought in today's educational settings.

Chapter 2 demonstrates how philosophical inquiry and other thinking theories can be used in the classroom. When appropriate strategies and resources are used and curriculum content assists students to explore meaning, analyse events, and make judgments, many of the requisite goals of current curriculum documents are satisfied.

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Art Speaks from the Kitchen

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Developing an effective classroom climate for higher order thinking

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Abstract

This chapter examines the contribution of the community of inquiry as teachers attempt to develop thinking classrooms. First introduced into education by Lipman's Philosophy for Children model (Lipman, Sharp, and Oscanyan, 1980), the community of inquiry involves establishing a classroom climate conducive to critical reflection. Philosophical inquiry, or using the thinking skills and reasoned analysis that philosophers have used through time, is a way of describing the discussions and thinking that occur when an appropriate classroom environment is in place. It is integrally linked with reading, discussing and seeing, each of which can re-acquaint students with experiences as well as introduce new concepts and ideas that are outside their daily lives. Although inquiry is a part of every curriculum area, it is only through the fostering of critical and reflective thinking skills that teachers can assist their students to become fully engaged using the areas of reading, discussion, and seeing. The processes used support the current emphasis on learning outcomes, inquiry learning, cooperative group work and the development of the individual.²

² There are many excellent texts with practical examples and resources that assist the development of a community of inquiry. For example, DeHaan, McColl and McCutcheon's *Philosophy For Kids*, Robert Fisher's *Teaching Children to Think*, Cam's *Thinking Stories* (various), Wilks' *Critical and Creative Thinking* (1995), Abbott and Wilks *I Think* (2000) and Lipman's *Philosophy for Children* series of stories and manuals, to name a few.

Philosophical inquiry

Philosophical inquiry is critical reflection, or thinking about thinking. The discipline of philosophy adds the following characteristics to classroom inquiry:

- (a) emphasis on what *might be*, as well as what is,
- (b) the application of logic and the use of criteria for measuring the quality of thinking,
- (c) creative, as well as critical thinking,
- (d) concern with matters of judgment and reason rather than fact and unexamined opinion, and
- (e) interest in the discovery of ideas and exploration of meaning, and concepts associated with the problematic in our everyday lives.

The skills developed in the philosophical inquiry approach are not discipline specific. It supports the emphasis in current curriculum documents on inquiry learning and the development of the individual in a democratic and pluralistic society.

If educators accept the theory that young children construct hypotheses to explain their view of the world, then they need to provide students with time and space to reason and think things through for themselves. Lipman's emphasis on class discussion is based on the assumption that discussion skills formed the foundation of thinking skills. The fundamental purpose of his Philosophy for Children program is the strengthening of basic reasoning skills rather than acquisition of knowledge. However, fostering problem-seeking and problem-solving dialogue that is not totally teacher-dependent requires specific teacher training.

The exploration of issues connected to students' experience and resulting from students' questions should form the starting point for inquiry and a lack of knowledge should not stand in the way of their ability to think. It follows that teachers need to ensure their students listen to, and take seriously, the opinions of others. As long as student thinking in the classroom remains focused on concrete situations and facts, they will find it difficult to build bridges to new situations.

Teacher controlled question/answer sessions around issues they have chosen do not necessarily create student interest or encourage inquiry. In order for thoughtful inquiry to occur, a cognitive experience involves students responding with their own ideas.

Although students lack knowledge, it should not prevent reflection and inquiry if we accept the constructivist view that knowledge and understanding are the results of inquiry, not the input to inquiry.

Philosophical inquiry offers both breadth and depth to inquiry and means the teacher, with their students as co-inquirers, can examine all sides of an issue, searching for implications and ramifications. Teachers need to master skills associated with leading a community of inquiry. One is the ability to push for depth in a discussion. This means finding ways of maintaining focus on issues. In order to distinguish between inquiry learning and philosophical inquiry the essential components of a community of inquiry are provided below:

- building on *students'* interest and reflecting on their questions,
- valuing both talking and listening, elements which provide both the verbal and social element of the reasoning process,
- giving and expecting reasons for what is said,
- students respecting themselves and others as participants in inquiry, and
- valuing thinking for oneself and 'self-correction' above the relatively sterile idea of formal logic (Thomas, 1992, pp. 101–2).

During adolescence students spend time thinking for themselves and examining future scenarios (Mares, 1993). They learn about decision-making and independence through trial and error. It is a time when they may expend great energy on quests and questioning. During this time of self-discovery, students need to explore values and define what may be negotiable and non-negotiable. They need to develop strong self-esteem and self-efficacy. Both will have an impact on their adult lives. It is a time when the peer group is influential, so their learning is best facilitated through the group. A community of inquiry provides the structure and approach to meet these conditions.

The middle years of schooling should offer an opportunity for students to develop their own voice and to recognise that meaning is constructed individually. Young people are more likely to be heard and become active participants and sensible decision-makers if they are able to express their ideas clearly and interact with others. This is especially important for the student who is not normally a confident or active participant in class. Their lack of interaction can often exclude them from much of the learning that is taking place in the classroom. Students who have poorly developed dialogical skills are often disadvantaged in cooperative learning situations. As well, the absence of meaningful interaction about issues that are important to the adolescent can reduce their interest in school. They often have a strong emotional interest in serious social and environmental issues and the opportunity for their interests to be expressed and examined needs to be provided.

Often, by the end of the middle years, students who have developed a voice have moved through active participation to leadership roles (Holdsworth, 1998). A community of inquiry with its supportive context, its challenging issues, and its encouragement of discussion of issues that interest the students, can help them develop a voice. It may provide what is required to involve many more students in greater participation and leadership in the school community.

Philosophical inquiry is not discipline specific. It can be applied across the curriculum as a vehicle to assist teachers to address the requirements of curriculum documents. It supports the development of the individual in a democratic and pluralistic society. The approach requires teachers to develop skills to handle rigorous discussions. The extent to which the students' questioning of others and clarification for themselves occurs is dependent on the teacher's ability to foster appropriate approaches.

Approaches that foster philosophical inquiry

To begin with, teachers need to provide an atmosphere in which the students feel they can disagree with one another without it seeming like a personal attack. The development of improved questioning skills by both teacher and students is an essential component of sound inquiry. Other important skills are the development of the students' ability to summarise what has been achieved by a discussion and suggest future directions for their inquiry.

Student questions play a prominent role in the community of inquiry or philosophical inquiry approach. Unlike classroom discussions which use question-answer routines (teacher-pupil, teacher-pupil etc.), one of the strengths claimed for the philosophical inquiry approach is the way it encourages the students to raise and explore issues with one another. Preferably, the patterns of dialogue in a classroom using the philosophical inquiry approach are:

teacher/student/student/student,

or

student/student/teacher/student/student/etc.

With dialogue at the centre of its methodology, a community of inquiry involves the teachers and their students becoming cooperative co-inquirers. The teacher's role is complex (see below) but it is important to strive to become the facilitator of the students' inquiry. The extent to which this questioning of others and clarification for themselves occurs is dependent on the skill of the teacher in encouraging such processes.

The teacher's role in a community of inquiry (Santi, 1993 p. 21):

- Facilitator** Help the circulation and comprehension of ideas.
Help students see themselves as problem seekers and problem solvers.
- Provoker** Stimulate participants to explore and deepen their own positions through opposition to given statements and by offering new cues for discussion.
- Modulator** Foster the cohesion of the discourse, leading the reasoning process towards the most productive directions. (This does not mean softening conflicts or resolving problems).
- Monitor** Control the correctness of reasoning and underline possible flaws in arguments. Encourage listening to others.
- Supporter** Support and encourage the cognitive operations involved in the thinking process, that is, provide 'scaffolding' for intellectual development.

Questioning

The nature of the community of inquiry means teacher's questions should assist their students to contribute and develop an awareness of the inquiry process. By using a form of Socratic questioning, questions such as: 'Am I right in saying you think ...?', or, 'Are you saying something different to Lee?', or, 'Who agrees with Gemi?', or merely saying a student's name in an expectation that he or she will speak, will encourage the students to be the discussants. The teacher in this model is the facilitator of their inquiry³ and will perhaps be less tempted to have too much to say in the discussion. Hearing other students' opinions exposes both teachers and students to a variety of points of view and shows there are many interpretations of any piece of information.

Over-intervention by teachers during a discussion can be a problem as it can remove the student-driven inquiry. Letting go of the 'power' can create an environment in which inquiry will flourish.

The prominence that students' questions are given in the community of inquiry should be emphasised. If the teacher has chosen a suitable resource (story, video, artwork etc.) that contains issues with philosophical depth that are of interest to the students, then the students will, and should be encouraged to, ask the questions for discussion. Writing their questions on a board followed by

³ There are many ways to encourage or discourage student participation: For example: pass a 'microphone' to the speaker (don't be surprised if you feel you want more than your share!); assign five counters to limit the number of times a student participates (this will show who is, and who is not, participating); assign students particular questions to ask during a discussion, etc.

their name (for example, How can he eat chicken when he doesn't support the shooting of ducks? (Sam)) and then discussing these questions, both shows the teacher what interests the students, and demonstrates to the students that their teacher values their input. This is good for their self-esteem and encourages further participation.

Langrehr's (1994, p.32) belief that teachers can develop better questioning that improves thinking processes led him to identify three groups of questions that are useful to remember (if not the label, at least the example) and are paraphrased below:

- **process building**—help produce series of student questions.
For example:
What are five questions you could ask yourself prior to trying to solve a maths problem?
What are six relevant questions to ask yourself about judging the reliability of someone's claim to know something?
- **connection building questions**—help students to make connections between content and link it in some sort of meaningful network or picture.
For example: What are four properties common to all trees?
What are two things in favour and two against people being able to walk in national forests?
- **question flexing questions**—help students break away from usual connections they make between related content. Such questions can involve reverse thinking, the use of random input, forced combinations, eliminations and elaborations, therefore shaking up traditional questions.
For example:
What if there were no more trees left in the world? What are five properties of a tree and how could you link them with improving breakfast cereal and the problems of the recession?

Using questions like the above will help the development of some or all of the following higher order thinking skills:

- comparing unrelated things,
- identifying relevant criteria for grouping,
- analysing parts and their relationships, and
- considering issues from different viewpoints.

Recognising a philosophical topic

Participating in philosophical inquiry does not mean 'anything goes'. Students should be expected to not only justify their answers but also be prepared to

articulate the thought that went into their comments. They also need to know that they are expected to back-up their claims with reasons and be consistent.

In order to lead penetrating philosophical discussions, the use of a cluster of follow-up questions to an initial exploration of a topic is helpful. Susan Gardner (1995) labeled this process the second ‘why’, believing it was the key to a process that teachers often struggled to achieve with their classes, the *philosophical* level of inquiry. An example of the two levels would be:

Q. (Level one)

Why did she boast about throwing rocks at the echidna?

A. Because she thought the others would think she was tough.

Q. (Level two – the second why).

But why does it matter what others think? Why do some people’s egos need bolstering, or is it something other than ego? Why do we say negative things when we are showing off? Does saying negative things make us feel better? If so, why? If we don’t feel better why do we do it? Might there have been an alternative course of action that would have been more successful in making her feel better?

Questions about behaviour in relation to intention and feelings provide a philosophical base. A question about which no one, including the teacher, knows the answer, such as the level two questions, can result in in-depth inquiry and perhaps insight.

Some teachers, misunderstanding the notion of a community of inquiry, have developed the habit of asking every student for their opinion on any topic under discussion, often expecting one student after the other to say something. This may lead to the students feeling they are wasting their time inquiring into a topic by swapping anecdotes, or maybe that there is a right answer which the teacher already knows.

While traditional teaching tends to reinforce a question–answer routine (teacher–pupil, teacher–pupil etc), philosophical inquiry nurtures the reflective habit by exploring difficult questions. Asking ‘How can we know that?’ crosses subject boundaries and is just as relevant in Art as it is in Science classes. It is by letting the students raise and explore such questions with one another that their experiences become more meaningful and they feel empowered to continue their search for meaning.

Example of philosophical inquiry

The following extract of a classroom discussion illustrates a typical exchange when teachers and students are using a philosophical inquiry approach. The students have developed the confidence to say what they think and display their

awareness of the art world in part because of the open-ended questions being asked by the teacher.

Notice the way the teacher treats the students as co-inquirers with something of value to contribute and the way she probes for meaning of terms and elaboration of reasons. (T = teacher, S = student)

T Are you going to try and clarify that for me L?

S Klee's paintings look like children's paintings or they look sweet and they have rhythm, but they are not made by children.

S In the museum in Paris, no, not the museum, the art gallery, on the second floor there's this little room and in it is a painting *Bathers at Avignon* and I think they look like Klee's work.

T Are you talking about the style in the way they are rounded and soft looking?

S No, the reason I'm talking about that is because they are more modern.

T In what way do you think they are more modern?

S They are more realistic.
Or, what's another word for that?

S Human.

T Human in what way?

S They all emphasise bodies.

S They don't have sort of communication, they have humans in them but especially this one, all these have nature in them and this one is pictures of humans showing nothing about them, they don't have other things about them.

T Who agrees with M that they are not showing anything about humans. P?

S I believe that they are symbol-like. There's more life in these pictures and I quite like that part.

T Who knows a word for that?

S Abstract.

T Are these more abstract then? We've come across that word now in a lot of different ways, like when they are not lifelike. But are we talking about abstract with these pictures?

S I think that Klee uses more definite shapes. Like with Mondrian's work you can't really see what that thing really is, but with Klee's works you don't have to keep wondering what it is because you know what it is.

The example below is from a middle years' classroom discussion facilitated by an experienced teacher. It describes the skills she has developed and gives an example of her question.

Facilitation skill	Example
• Making explicit the thinking processes in the inquiry.	What criteria did you use when you made that judgment?
• Assisting with the circulation and comprehension of ideas.	Can we explore that idea some more?
• Helping students see themselves as problem-seekers and problem-solvers.	How many issues are we raising here? How are we going to proceed?
• Stimulating students to explore their own positions.	Would you be able to explain that deeper thought in greater detail?
• Fostering the cohesion of the discourse, leading the reasoning process towards deeper levels of meaning.	Let's turn that idea around and look at the opposite viewpoint.
• Controlling the correctness of reasoning, unraveling possible fallacies in arguments.	Can anyone suggest another way of looking at it?
• Modelling and encouraging listening.	Am I correct in thinking that you are effectively saying ...?

Students require the opportunity to engage in the sort of open-ended dialogue that encourages and supports reasoning and higher order thinking. The community of inquiry approach, when combined with resources that stimulate inquiry, assists students to deal with abstractions and higher order thinking long before the onset of Piaget's so-called 'formal stage'.

Essential teacher strategies and classroom environment for a philosophical inquiry approach

Years of nurturing philosophical inquiry has led to the following traits being listed as **essential requirements** for teachers and students to develop. They should:

- appreciate the process of **wondering** about, and **reflecting** on, issues and ideas,
- value the **asking of questions** about the nature and significance of objects and ideas,
- seek out, and **listen carefully** to, others' **points of view**
- carefully present and **evaluate reasons** to support one's own ideas, and
- develop an awareness of their own and others' **values** and beliefs.

The appropriate classroom environment for fostering higher order thinking requires:

- **resources that raise questions** about value laden situations,
- **students responding to one another** rather than always to the teacher,
- **eye contact** between students (re-arrange seating if necessary),
- **l-o-n-g-e-r wait times** to give all students the chance to reflect, formulate ideas and join the discussion,
- **encouragement, not suppression** of philosophical issues as they emerge,
- **more student talk**—less teacher talk,
- **not seeking a particular answer** during a discussion,
- **an environment that encourages student questions** about issues,
- **modelling of good reasoning, reflection and listening skills** and,
- **naming the thinking skills**—the higher order thinking that is occurring should be explicit.

As with any worthwhile and complex classroom strategy, for successful learning and teaching to occur, teachers will require appropriate in-service training. Discussion skills, such as recognising when it is important to point out an assumption or follow a divergent line of reasoning, are only acquired through practice.

Philosophical inquiry can be used effectively with the differentiated curriculum and diverse levels of cognitive development and literacy. The practices involved in this approach include participation and negotiation, experiential and active learning, discussion and reflection.

By the upper primary years, students normally have a command of logical reasoning together with a concern for interpersonal and social aspects of life and an interest in moral and ethical questions like fairness and equality. Appropriate literature, artworks, films and scientific puzzles, and so on, raise challenging ethical, social, environmental and logical issues appropriate for students in the middle years of schooling.

Good thinking skills are required in all facets of the curriculum and an effective community of inquiry will assist with the transfer of knowledge. In a secondary school, adolescents would benefit from having a community of inquiry established in two or more key learning areas. Time needs to be allocated for establishing the requisite skills and, once these are established, they can be used across the curriculum. While the community of inquiry might

appear to fit most comfortably in English and Studies of Society and Environment (SOSE) classes, it also has much to offer students in Art, IT, Science and Technology, wherever students are encouraged to seek understanding, think critically and examine ways of making meaning.

Examples of philosophical inquiry in the curriculum

In the classroom, teachers need to employ specific approaches that emphasise the processes that are associated with inquiry and critical thinking. This involves directing attention to the interesting or problematic issues in texts and other resources as well as dealing with content. In arousing curiosity and recognising the benefits of the process of discovery, learning how to use the tools of inquiry must follow. The examples below have not been linked with specific levels or strands of curriculum documents, but are offered as illustrations of the theory at work.

Example 1: SOSE and English

Following a schoolyard instance of bullying, a class might consider the difference between harmless and harmful teasing. SOSE and English curriculum documents require students to examine the values that they, and others, hold. They have to figure out how concepts and ideals like fairness and justice relate to their lives and the institutions of which they are part. As discussions develop, the students should become aware of their beliefs and, importantly, learn that they may be mistaken in certain instances and that such mistakes are not the 'end of the world'.

Example 2: SOSE and Science

A philosophical discussion in SOSE might follow a news item on protests against duck shooting. This could lead to a discussion of the question 'Should animal rights be the same as human rights? How do we decide?' In Science or Environmental Studies, a class could consider whether a mill hand's or forestry officer's comment that 'Most wood chipping is harmless' is based on sound reasoning and with justifiable authority.

Example 3: Technology

In Technology when trying to decide on appropriate materials for kites, it would be useful for students to be able to develop criteria to suggest improvements to designs. Examining assumptions about how things work, and being required to both explain and justify ideas, are important elements of the design process.

Example 4: Art and SOSE

Philosophical inquiry in the visual arts could link viewing, conversation and writing with resources (print, screen, music) that are meaningful to the students. Following public outrage at the placement of a modern sculpture in the city square, a discussion could include an examination of the complex issues associated with meaning in art. The discussion would involve concepts of reality, power and culture, all critical to students' understanding of the connection between art and their own lives.

Both abstract (conceptual) and concrete thinking can be explored through inquiry. Exploration of issues that are problematic for the student, yet connected to their own experience, can act as a starting point. For instance, in English, the text *Onion Tears* (Kidd, 1993) contains the issues of identity, change, communication, courage, trust, relationships and difference. Questions such as: Can you be friends with a person you do not like? and, Are we the person we see, or the person someone else sees? can be used to direct the inquiry from the concrete and personal to the abstract.

Philosophical inquiry promotes knowledge of the ways both visual and textual interpretation and understanding may vary according to cultural, social and personal difference. These factors may also influence the capacity to develop reasoned arguments about interpretation and meaning. It means students are given the opportunity to ask questions, to dig more deeply for meaning, and to explore their own beliefs, attitudes and values.

There remains the question of whether active learning, critical thinking and creativity can be evaluated in a way that is compatible with current assessment systems. Some schools with critical thinking programs in their curriculum have developed ways of assessing student progress. The way problems are defined and progress is gauged needs to be discussed by schools as the new methods are introduced into their curricula. Policy documents need to be framed so they assist implementation of critical thinking and inquiry. Further models for assessment and reporting are discussed in later chapters of this text.

Schools that take up the challenge to foster learning via a community of inquiry approach will find their own ways of bringing about change according to their organisational structure and needs. Golding (Chapter 3) and Meath (Chapter 4) offer excellent advice in this area. Good school policy documents will stress the importance of stimulating healthy conversation and encouraging teachers to inquire into fundamental curriculum matters and argue about them. In so doing, they will use the very skills and dispositions they should want their students to develop. These skills: listening, problem solving, reasoning, questioning, collaborating, and democratic decision making, are all encouraged by philosophical inquiry.

A model of a 'thinking school' established in Denver, Colorado by the author of *Schools of Thought* (Brown, 1993), and exemplifying the application of big ideas, rich tasks and authentic engagement through an integrated curriculum, is described below.

A model school of thoughtfulness

Abstract

In order to put good theory into practice Rex Brown set up Charter School PS1 in Denver, Colorado. This school stands as an excellent model for teachers attempting to implement a thinking school for middle years students. Its curriculum

incorporates the approaches and content viewed as suited to a thinking curriculum. Its focus is on interdisciplinary, urban studies. Parents and other community members are actively involved in each child's education, and students are viewed as individuals with unique talents and participants in the learning exchange. Students are mostly self-motivated and independent, working with their parents and teachers to create a Personal Learning Plan and learning at their own pace.

Schools of thought

In 1993, Rex Brown travelled the US with a team of educators looking for classrooms that exhibited thoughtfulness, experiential learning and critical thinking. However, in a book called *Schools of Thought* (1993), he reported that what they found when observing classroom discussions was, in most instances, just the opposite to thoughtfulness—what he described was student and teacher 'powerlessness'. The more dependent the students became as a result of experiencing 'closed' classroom systems—developing recitation patterns of teacher/ student/ teacher/ student, closed questions, lower-order cognitive activities, and over-reliance on textbook information—the more resistant they were to taking the opportunity to acquire new skills when the occasion arose. When teachers tried to change the status quo, they often found the resistance too difficult to penetrate.

Having been unsuccessful in bringing about the change he felt was required to turn schools into thoughtful places, Brown established a Charter School based on the following philosophy:

The future belongs to young people who know how to create and participate in learning communities; who know where knowledge is, how to get it, how to think about it and how to use it. They are the ones who will be able to take the greatest advantage of whatever opportunities an unpredictable and rapidly changing world throws their way. The best way to expose students to the Information Age is to place them right in the middle of it.

(Rex Brown, Founding Director, in PS1 Information Booklet)

At PS1, a diverse learning community was created. It comprised a network of people who knew how to seize learning opportunities wherever they appeared and use knowledge to create products for better work and better lives. Parents, students and teachers worked together to design fresh and challenging learning experiences.

In addition to the regular academic program, students at PS1 have the opportunity to undertake:

- **internships**—they can link with local businesses and organisations to learn more about a profession or trade through hands-on experiences.
- **independent study**—develop a project or course that allows them to concentrate on a specific field or topic.

- **service learning**—develop projects that make their community a healthier, more beautiful place in which to live.
- **student-taught classes**—develop a course they teach to other students.
- **senior project**—create a project that integrates what they have learned.

Course offerings are in the form of:

Workshops

Science Survey, Literature and Composition, Interactive Maths, British Literature, Spanish, African Culture and Literature, Drawing and Painting, Physics.

Projects

Winter camping/survival, Generations, Construction and Design, Film Studies, Urban Science Centre, How Stuff Works, Journeys—The Power of Travel.

Electives

Rock climbing, Ultimate Frisbee, Theatre, Sign Language, Eastern Thought, Martial Arts.

Study tours

To Durango—to study Native American culture and the influence of Mexico, to the Mountains—for a 3-day camping adventure, to Washington DC for a Schools' Conference.

The school takes advantage of the urban community in which it is situated. It lists its extended campus as the Denver Art Museum, State Capital, Museo de las Americas, Denver Health, University of Colorado, local Television Stations, Civic Centre Park, Stadium District and the Platte River.

The school has an open admission policy and requests that students wishing to enrol should submit three pieces of work of which they are proud to help determine their learning styles, skills and needs. Students are asked whether school is an important part of their life (why or why not) and what unique contribution they would offer the school. Parents are asked how PS1's unique educational philosophy will attend to their child's specific needs and what they can bring to the school as a participating member of the school community.

The following PS1 course (2002) demonstrates how the school is responding to all the issues discussed in this section.

Topic: Generations

(Contact hours: 7 per week for a term)

Course description

Provides opportunities for students Years 5 to 12 to be involved in cross-generational relationships. Activities will help students develop more empathetic mind

sets as they explore how their concerns and needs are similar to those of the aged. These include:

- feeling cared for and respected,
- having a sense of belonging, yet being independent, and
- being treated fairly.

Issues associated with ageing will be presented to students with an emphasis on regarding it as a healthy, natural, cycle of life and on recognising cultural differences in attitudes towards ageing. Students will become sensitive to detecting knowledge which is accurate and without stereotypes as they focus on the benefits and importance of inter-generational understanding.

Through this interdisciplinary study of the physiological and psychological processes of ageing, students will also be encouraged to develop positive habits that will enhance the quality of their own lives as they grow older.

Inquiry

In what ways can inter-generational groups experience associations and develop critical thinking skills wherein they develop a greater understanding and appreciation of each other, the process of ageing and the treatment of the elderly?

Exploration

Learners will:

- develop skills to initiate and create conversations with the elderly,
- recognise life events that are associated with ageing across the lifespan,
- investigate factors that affect the quality of life for all, but especially the aged,
- become aware of the multiple ethical issues associated with ageing, and
- gain an understanding of cultural differences and attitudes towards ageing.

Discovery/Outcomes

Learners will:

- develop stimulating cross-generational relationships,
- improve their understanding of the physiological and psychological processes of ageing,
- increase their awareness and sensitivity to societal attitudes about ageing and the needs and concerns of the ageing population across cultures, and
- demonstrate an increased ability to make critical choices for extending and enhancing life at all ages.

Reflection/Assessment

Learners will:

- attend class every day and be on time to class,
- actively participate in regularly scheduled visits to homes for the elderly and help plan and prepare activities for these visits,
- create a biography of an older friend, demonstrating the connections between their life and that of their new friend,
- examine the physiological and psychological processes of ageing, explore concepts of good general health throughout life, and report on their studies,
- investigate the portrayal of older people in the media and selected literature and discuss their thoughts and findings with their class,
- research and create a product or service to help meet the needs of the ageing population, and
- maintain a 'Generation' notebook that will document class work, homework, reflections, and evaluations of what they are learning in written transcripts.

Assessment at PS1 is on an individual basis. Students build Portfolios showing evidence of growth. Once a term there is a Presentation of Learning day. On these days students make presentations to peers and invited experts in their fields of study. Students are also given State and internal tests. Learning is standards-referenced rather than standards-driven. However, it is important to note that the students perform well on State administered tests.

Note: The Editor visited PS1 in 2002 and observed the curriculum, as written down, was also visible in daily practice.

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Man Made
Susannah Wimberley
Year 12 Frankston High School

Creating a thinking school

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Abstract

Clinton Golding, a practitioner with many years' experience in leading a thinking curriculum in schools, describes the conditions necessary for a thinking curriculum to become a reality in a school. He argues for authentic learning and assessment, explicit reference to the thinking curriculum at all levels, and involvement of the whole school community. He has included a Thinking School's Checklist.

Creating a thinking school

We don't just want our students to be better thinkers so they will have skills needed in tomorrow's world. The point of a thinking school is to develop students who are well-rounded, responsible persons. We want our students to gain the skills they will need for the future, that is, to be critical, creative, collaborative and caring thinkers, because this will make them better citizens. Focus on the students' skills is one aspect of the current trend in the development of thinking in education. Equally important is the establishment of an environment, background conditions, and a culture necessary to encourage students to develop their thinking.

What is meant by developing thinking skills?

Developing student thinking cultivates independent and responsible thinkers. It means developing thinking skills and habits to make a positive difference in learning and living. 'Thinking' students are skilled at making good decisions, are creative and critical, and can analyse, evaluate and apply what they know. They can also monitor their own thinking processes in order to modify or improve them when necessary. Thinking students are also aware of the ethical implications of their ideas and actions and can learn to make good decisions. Art Costa calls a school that is developing the thinking dispositions of its students in the way described above as a 'thinking school'.

In the future, students may change careers many times and will be bombarded with huge amounts of dubious information and unexamined values. They need to develop their thinking so they have the skills to deal with a world of uncertainty and complexity.

Cultural change necessary for the successful development of thinking in a school

For a thinking program in a school to be truly effective, the culture within some schools will need to change. It must be dedicated to the goal of being a thinking school.

The culture of a school is evident in what it states, values and achieves. It is also evident in what is expected of students. Today, many schools are committed to finding ways to develop the thinking of their students. Focusing on developing knowledge, passing tests, and getting through curriculum requirements are no longer seen as sufficient.

Unfortunately, many schools only get as far as teaching thinking skills. Achieving the cultural change required to consolidate the critical thinking of students involves more than just learning some new skills. It requires changing viewpoints, goals and habits in a school community.

Knowing how to do something makes very little difference on its own. (How many of us know how to lose weight?) It is not enough that staff or students know how to use certain thinking tools or skills. The culture of the school must be such that students and staff use the tools and skills as often as possible and apply their decision-making and problem-solving skills to all areas of their lives.

The kind of cultural change that is necessary to create a thinking school demands that teachers and students change their educational goals. The school has to promote education as a means of developing habits of thinking rather than merely being a way of learning information in order to pass tests and get a job. Curriculum areas should be considered as a means of encouraging and developing different thinking processes and abilities around subject matter. Teachers need to work as professional learning teams on the common goal of developing the thinking of students rather than as promoting their own discipline. At first this might be difficult for secondary teachers used to distinct subject domains.

Conventional versus thinking schools' views of education

The table on the following page contains a summary of the sort of cultural change that is required. In creating a thinking school, we are moving from the conventional view of education, which is not consistent with a thinking school, to an alternative 'thinking school' view of teachers, students and education.

Cultural change

Changing a culture means reorganising the fundamental ways an organisation operates. It is a major undertaking to develop a school to the point where it focuses on producing independent and responsible thinkers, and where it attains this goal. Studies of organisations attempting such major undertakings indicate the process takes between three and five years before significant results occur.

How does such a major culture change come about? How can a school change the fundamental ways in which it operates so that the thinking of students can be significantly developed? Changes in the whole school environment, the school community and in particular in the nature of education and the role of the teacher are needed. Normally the principal and senior management team instigate such broad changes, but individual teachers, with senior management support, are sometimes behind the drive for change.

Conventional view of education, teachers and students	Thinking schools' view of teachers and students
The focus of education is on passing on information, correct answers, facts and data to students.	The focus of education is on developing thoughtful students.
Education is to ensure students know everything they need.	Education is to engage students and get them to change and grow.
The units of education are knowledge already gained, information, correct answers, facts and data.	The units of education are suggestions, inferences, suppositions, tentative explanations and ideas.
The aim is to have students cover certain content and reach a certain level of knowledge.	The aim is to have students develop thinking skills and behaviours.
The teacher's main role is to be the source of knowledge and information. They must ensure students have covered the content.	The teacher's main role is to be a facilitator and coach of students—to help them to develop thinking skills and behaviours.
The teacher's task is to evaluate whether the students have got the right or wrong answers.	The teacher's task is to help students learn how to inquire and evaluate for themselves.
The curriculum gives content to cover.	The curriculum gives processes and skills.
The teacher's role is to make sure students have covered the curriculum content and can pass the assessment tasks.	The teacher's role is to help students to develop the skills and processes from the curriculum.
The teacher assesses retention of the student's knowledge and answers.	The teacher assesses whether students have mastered the thinking processes and skills.
The student's task is to learn the knowledge so they can pass exams and assessments.	The student's task is to think, inquire, learn, discuss ideas and figure out the best answers to problems.

A supportive culture for a thinking school

What can the principal and curriculum leaders do to develop and improve the thinking within their school? There are eight main areas that need to be addressed to ensure the school culture supports the goal of being a thinking school.

- a Ensure the development of thinking is an explicit aim of the school.
- b Model and personally promote the development of thinking.
- c Create a school environment that promotes the development of thinking.
- d Ensure time is explicitly set aside for the development of thinking.
- e Encourage teachers to consider themselves as facilitators of thinking.
- f Ensure that students consider themselves learners and thinkers.
- g Provide time, resources and training to support teachers in developing thinking students.
- h Inform the wider school community and involve them in creating a thinking curriculum.

Each of these areas will be examined below in terms of what needs to be done, why doing this is important, and questions that can be asked to help develop the scaffolding required to turn schools into thinking environments.

A. Ensure the development of thinking is an explicit aim of the school

If a school is to develop the thinking of its students then it needs to be explicitly stated in its charter and curriculum statements. If a school is not overtly focused on the development of thinking, teachers and students will not see this as their purpose at school.

Ways to ensure the development of thinking becomes a school goal include:

- departmental reporting based around the development of thinking,
- writing the development of thinking into a school motto, for example, 'Longview School values thinking',
- writing the development of thinking into the school charter, mission statement, values or goals, and
- creating action plans to achieve the thinking school's goals.

B. Model and personally promote the development of thinking

As well as having the development of thinking written as an explicit aim of the school, the senior management needs to model good thinking and personally promote this aim. If a principal wants creative, flexible and accurate thinkers, then she or he must model flexible, creative and accurate thinking. If questioners and analysers are desired, then she or he must ask students to analyse and ask questions and indicate that these are worthwhile things to do.

If staff and students see and hear the senior management acting in accord with the stated aim of developing thinking, then they will be more likely to follow suit. There are a number of ways the senior management can model and promote the development of thinking in a school. They should:

- talk to staff individually about their vision and aims,
- hold staff meetings on the topic of developing thinking,
- show that they take some time to thoughtfully consider comments and questions,
- share the questions they are still trying to answer,
- carefully listen to what staff and students have to say,
- demonstrate that they value good thinking,
- make thinking and the development of thinking a topic they often talk about,
- share areas in which they have developed their thinking,
- describe their thinking and how they managed to ‘figure things out’,
- ask for students to do some thinking. Ask them questions such as, What do you think about this? and How could we improve that?, and
- praise or reward instances of good thinking processes.

C. Create a school environment that promotes the development of thinking

Every aspect of the school environment should promote the development of thinking and there can be no inconsistencies. For example, academic awards should include prizes for good thinking and the rules of the school should call for thoughtful behaviour.

There is no point saying thinking is valuable while the environment of the school actually represses opportunities. For example, if we teach that listening to others is good thinking behaviour but we don't listen to students' ideas or their explanations for their behaviour, then they won't be interested in developing good listening habits as part of their thinking development. If we say that development of independent thinking is important, but we don't allow students opportunities to discuss and talk about the school rules or their treatment at school, then we won't develop their thinking. If we say questioning is good, but we never make time for students to question what they are doing and why they are doing it, then they will not value questioning. Students react to mixed messages and will ignore the advocacy of thinking skills when the school environment does not match what we say is important.

In order to establish an environment that promotes good thinking, there needs to be a thorough investigation of the school's systems, structures and environment. The following could also be examined:

- **reporting**—are there specific comments on the development of students' thinking abilities on report cards?
- **physical environments**—classroom and general—are classrooms arranged in a way that invites student to student interaction, discussion and thinking?
- **auditing subjects**—are they audited for the thinking skills being promoted?
- **extra-curricular activities** such as sport and extension work—are these being audited for the thinking skills being promoted?
- **staff hiring policies**—are these based on candidates being willing and able to develop the thinking of students?
- **departments systematically involved**—are all departments promoting certain thinking abilities and habits?

D. Ensure time is explicitly set aside for the development of thinking

The most obvious way to have the environment of a school promote the development of thinking is by setting aside time to be used for this purpose. What is really valued by a school can be established by looking at what has been assigned time-slots in any given busy week. Whether a school values maths, science, art, writing, sport, music or grammar becomes obvious. Staff should be released from other tasks so they will have time to devote to the development of thinking in their classes. This is not the same as having some thinking

development happen as a side effect of, say, doing English. There also needs to be a time set aside explicitly to establish ways of developing thinking skills.

Without time being used solely for the development of thinking, students will not examine their thinking and teachers will see all the other things they have to get through as more important than developing the thinking of their students. In either case, the students' thinking skills will not be developed.

There are a number of ways to devote time specifically to the goal of developing thinking.

- There could be a designated thinking class that focuses only on developing thinking.
- Time could be used in the different subjects for the development of thinking—perhaps different subject areas could teach different thinking skills or behaviours.
- Explicit thinking components can be built into unit plans.
- Special times throughout the school program could be used for thinking activities.

E. Encourage teachers to consider themselves as facilitators of thinking

Staff should view their role as thinking facilitators to be at least as important as any other role they have as teachers. In fact, for best results, they should see the development of thinking as their prime goal and everything else, for example, transfer of knowledge, as the means of reaching this goal.

Even if they can't articulate it, teachers will be operating implicitly according to a particular view of what education is and their role in the education process. The traditional culture of schools makes it difficult for teachers to see themselves as thinking facilitators. For teachers to become coaches or facilitators of thinking, they must move from the view that their role is to be the source and evaluator of knowledge. Their role is to encourage and promote students' thinking so they can do this themselves, rather than doing it for them.

In order to take on the role of a thinking coach, teachers need to:

i. Make the development of thinking an explicit aim of a classroom

Both as a reminder for yourself and for the students, there needs to be an explicit statement that your classroom is designed to develop the thinking of students. This needs to be discussed with students regularly. The students must know that the purpose of the class is to develop their thinking.

ii. Model and personally promote the development of thinking

Teachers should practise and model the same skills they want the students to develop.

They need to ask questions and answer questions asked of them. They can admit that sometimes they make mistakes, that they need time to think well, that it is OK to take risks in thinking, and that there is nothing wrong with sometimes giving an incorrect answer. They can also make their thinking obvious to the students. This can be done by thinking aloud or by explaining the thinking process that led them to certain decisions and actions.

To personally promote thinking, teachers must shift their focus from promoting correct answers to promoting thinking behaviours and skills. The teacher should avoid judging the students' ideas as correct or incorrect. Sometimes making no judgment allows more independent thinking from students, and it trains the students to evaluate their own and each other's ideas. Instead, teachers can acknowledge any important points or new ideas, interesting angles or variations offered by a student. Praise should be directed at how well students have performed thinking processes and how well their opinions show they have performed it, rather than at their conclusions.

iii. Have the environment of the classroom promote the development of thinking

The environment of the classroom needs to promote the development of thinking. In particular, the teacher should seek to create an environment where students are called upon to think broadly and deeply and where they feel safe and comfortable enough to want to take risks in thinking. For example:

- tests, assessments and activities that emphasise and grade the thinking process rather than just the product should be used, and
- the resources and training that lead students to value and have opportunities to practise their thinking should be provided.

As part of creating an environment for thinking, teachers need to attend to the physical space of the classroom. Having the standard classroom arrangement of students all facing the teacher at the front does not promote thinking, but keeps students in the mode of information absorbers. Some suggested ways to arrange a classroom are:

- flexible arrangements where the teacher is not always dominant at the front of the room, and
- seating placed in a circle or semicircle so everyone can see and interact with everyone else—this encourages teacher–student and student–student interaction and questioning.

d. Have class time set aside for development of thinking

As a coach of thinking, teachers need to provide the time for students to think and develop their thinking. First, teachers might have a time set aside for thinking in the same way that they might have a specific time in the day set aside for maths, science or silent reading. There may be a thinking subject or time within other subject areas for developing the thinking associated with it—for example, problem solving in maths. Second, teachers need to give students the time to think well during all their classroom activities. A ‘wait’ time or thinking time after asking questions and after an answer is suggested. This will enable students to think about what has been said. To provide time for this thinking, teachers should not artificially stop the process by providing conclusive answers or moving on too quickly. This requires teachers to listen actively to their students and promote risk-taking and playing with ideas. They must accept multiple answers and encourage inventiveness.

Some specific examples of ways of increasing the thinking time of students are:

- never accept immediate answers to questions—always wait a few seconds that is explicitly termed ‘thinking time’,
- model sample responses so students have an expectation of what to do,
- have students write responses or share with a partner before giving the idea to the whole class,
- find other means of ensuring there are responses from all class members (for example distributing five beads to each member of a discussion group, each one representing permission to speak), and
- accept all responses, but ask the students to evaluate them.

F. Ensure that students consider themselves learners and thinkers

Although they will meet with student resistance borne of years of being able to escape having to think for themselves, teachers need to help their students realise that they are in class to develop their thinking. For best results, students, like teachers, need to see that everything they do at school serves their primary goal of becoming better thinkers and learners.

One way to do this is to be very clear and explicit about what thinking is required from students. Teachers need to use thinking terminology to be as clear as possible in asking students to improve their thinking. They should avoid just saying ‘think about that’, but be specific about the thinking operations required, for example:

- Analyse the differences between ...
- Come up with reasons for and against ...
- Imagine other possibilities ...

Label, classify, and categorise as well as praise any good thinking behaviour that occurs.

If students don't see themselves primarily as thinkers and learners, then the various constraints and pressures of traditional school life will always override the goal of developing their thinking. There will always be something that is more important to do. If the teachers see themselves as thinking coaches, but the students see their job as passing tests or learning facts to get a job, then the teachers will not be successful coaches. The students will not see the point of the activities and lessons their teachers provide if they cannot see their benefits.

Like teachers, students have their own ideas about their role at school. Even if they can't articulate this role, they too will be operating according to a particular view of education. However, because of the traditional culture of schools, the role that students see for themselves is unlikely to be as thinkers or learners. To change the culture of what it is to be a student, we will need to give clear explanations and expectations to show that what we want from students is not the same as the traditional idea of schooling. Students are being asked to participate in a different style of education. Unless they know exactly what is expected and know how to match the teacher's expectations, they will continue as they have always done and they will not develop new thinking habits.

Some ways to develop the role of students as thinkers and learners include:

- emphasising thinking and learning, for example, celebrating success in verbal and physical presentations in workshops, at assemblies and in classroom interaction,
- making good thinking and learning (creative, critical, analytical, strategic) an integral part of their daily activities,
- focusing on thinking and learning processes rather than final answers, and
- adopting issues, topics and subjects of study that the students select and they want to learn about.

G. Provide time, resources and training to support teachers in developing thinking students

Without support and professional development training, teachers will know what they want to do, but will not be able to do it properly. They need time to practise the methods, activities and styles of teaching that develop and promote the thinking of students.

This can be achieved by:

- providing professional development courses on improving thinking skills for teachers,
- buying support materials such as books, articles, and teaching plans,
- organising thinking experts to work with the whole staff,
- training a few staff who then train other staff,
- having one or more people on staff who work as the thinking development team,
- allotting time for staff to reflect on what they are doing and to get better at developing the thinking of their students, and
- finding time for teachers to share student successes, commenting on particularly good ways of thinking about something, for example, establishing reflection groups across departments.

H. Inform the wider school community and involve them in creating a thinking curriculum

The wider school community needs to be involved as students don't just think and learn in school. The community in which the school operates should be involved in the process of developing a thinking school. Students require opportunities to use their new thinking habits in the 'outside' world and to see that this is valuable. They must have opportunities to transfer what they are learning to their lives outside school. The development of thinking within a school will be much more effective if

- parents and community are actively engaged in developing the thinking of their children,
- local professional, trade and business people come to school and talk about the thinking involved in their work,

- students see the thinking that occurs behind community decisions, and
- students think about community issues.

The wider school community could be involved in developing student's thinking by:

- having the students thinking with members of the wider school community—for example, discussions with the board or parents,
- having students think about community issues,
- training parents and board members in thinking alongside the students,
- having students visit the wider community (zoos, businesses, museums, galleries) to experience what thinking skills they find there, and
- inviting members of the community to share their processes of thinking, for example, a builder explains how he or she solves construction problems, similarly invite a tailor, caretaker and so on.

A Thinking School's Checklist

1 *What is the stated purpose of your school?*

How could you make the development of thinking part of the stated purpose of your school?

2 *Do senior personnel model or promote thinking?*

How could they model, promote or open up good thinking from staff or students?

3 *Think about the different aspects of your school environment:*

Which aspects promote the thinking of students? Which aspects do not promote thinking, but restrict thinking or steal the opportunity for students to think for themselves?

4 *How much time is explicitly devoted to developing thinking?*

How could you free up and assign some time during the week when developing thinking would be the explicit aim?

5 *What do teachers at your school see as their primary role?*

How could teachers at your school be encouraged to see themselves as thinking coaches and facilitators?

6 *What do students at your school see as their primary role?*

How can students at your school be encouraged to see that their primary role is to be learners and thinkers?

7 *What support do teachers currently have for developing thinking?*

What support could be offered to your teachers so they are more effective at developing the thinking of students in your school?

8 *To what extent is the wider community involved in the development of thinking at your school?*

How can the wider school community be involved in the development of students' thinking?

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Using a thinking curriculum to guide learning in the middle years

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Abstract

As Thinking Oriented Curriculum (TOC) and Special Programs Coordinator within her school, it is Meath's role to support teachers as they infuse thinking skills into their programs. She also assists curriculum leaders, year level coordinators, and team leaders to address thinking skills from Years 7–12. In this chapter Meath describes what she believes are the important theoretical underpinnings of an effective thinking curriculum, keeping in mind the needs of students at both classroom and whole school levels. She demonstrates what Queensland's New Basics Project and other models offer the thinking curriculum and has designed an effective Materials Technology unit.

Introduction

As a teacher with twenty-two years of experience I believe that within our daily role of interacting with, and teaching, adolescents it is necessary to constantly reflect on where we want to take our learners and what kind of future we want to prepare them for. The successful school will be one that embraces new theories of education and delivers curriculum infused with deep knowledge and deep understanding and one that recognises higher order thinking skills and metacognition as central keys for developing life-long learners.

The pathway students typically follow as they learn is linked intrinsically to their developmental age and capabilities and the teaching and learning they are exposed to. It is vital that as teachers we ensure that effective learning takes place within the classroom.

The ideology behind the Thinking Oriented Curriculum is not new. Effective teachers have been incorporating thinking skills into their pedagogy since

early days. With a fast changing world it is apparent that now, more than ever, we should be knowledgeable in this area as our charges will be the caretakers and future leaders.

Another reason for teaching the skills of thinking is that teachers are faced with the challenge of providing a basis for their students' effective participation in the community of the future. Wilson (2000) lists some important applications of thinking for today's youth. These include:

- collecting information
- sorting information
- analysing information
- drawing conclusions from information
- 'brainstorming' new ideas
- problem solving
- determining cause and effect
- evaluating options
- planning and setting goals
- monitoring progress
- decision-making, and
- reflecting on one's own progress.

These skills are based upon the assumption that thinking (cognition) goes beyond the acquisition of knowledge.

The New Basics

The New Basics Project initiated by Queensland State Education (<http://education.qld.gov.au/corporate/newbasics>) is an excellent example of a curriculum framework designed for the teaching of thinking skills such as those summarised by Wilson. A set of Rich Tasks delivered with Productive Pedagogies in conjunction with the New Basics categories of curriculum organisers form the basis of this reform package.

The **Productive Pedagogies** provide explicit teaching strategies for the classroom teacher and include:

- recognition of difference (cultural knowledge, inclusivity, narrative, group identity, citizenship),
- connectedness (connectedness to the world, problem based curricula, background and integration knowledge),
- intellectual quality (Higher Order Thinking Skills [HOTS], deep knowledge and understanding, substantive conversations, knowledge as problematic, and metalanguage), and
- social support (student control, social support, engagement, self-regulation, and explicit criteria).

The four **conceptual organisers** include:

- Life pathways and social futures.
Who am I and where am I going?
- Multi-literacies and communication media.
How do I make sense of and communicate with the world?
- Active citizenship.
What are my rights and responsibilities in communities, cultures and economies?
- Environments and technologies.
How do I describe, analyse and shape the world around me?

The Rich Tasks are developed with student needs in mind and may be cross-curricula in focus, for example, Year 9 Rich Task 4—Australian Identity: Influences and Perspectives. They are designed to give students meaning to learning and relevance to future needs.

Education Queensland attempted to encourage teachers to un-clutter the curriculum, increase intellectual rigour, and prepare students for a future in an ever-changing world. I was impressed with The New Basics' positive approach to change, but could not help thinking about what Rexford Brown described in his book *Schools of Thought* (1993). He emphasised that top-down policy decisions about education reforms will only be effective with sufficient political and monetary backing. But, for any reform to penetrate the classroom, a strong core of teachers with the passion to support it (in this case a thinking curriculum) is required.

Students as critical and creative thinkers

Students need to be able to be problem solvers and to think critically and creatively in order to process new ideas and concepts. To be able to work in teams they need to have the capabilities of cooperation, communication and negotiation. A high degree of intellectual curiosity and the ability to analyse information will assist them with the flexibility and resilience to cope with change. All of these things can be nurtured in the Thinking Oriented Curriculum.

For this to occur, teachers must take time to develop relationships with their students and assume the role of mentor and coach. A collaborative approach always works best. Teachers can provide challenges as well as respect ignorance.

If teachers consistently model thinking and learning strategies it helps their students to feel secure enough to take risks in their learning. Risk-taking in learning takes place when the students trust their teacher as a leader in learning. This is what moves the learner on, they feel empowered to engage in authentic learning and take chances. It takes time to honour the learning process and we need to allow that valuable time.

Brown (1993) argues that to teach thinking skills does not call for structural changes in schooling and if teachers use the thinking of the theorists of Thinking Oriented Curriculum they can create an environment of thinking.

There are **three main approaches to the teaching of thinking skills**. They are direct, discipline specific and infusion:

- The **direct approach** entails teaching explicit skills such as DeBono's Cognitive Research Trust (CoRT) thinking skills. This includes teaching Direct Attention Thinking Tasks (DATT). In CoRT students are given strategies such as PMI (plus, minus and interesting), C&S (consequence and sequence) or CAF (consider all factors) to solve given problems. It provides them with an explicit strategy to pull a problem apart. Students can then apply a chosen DATT when any problem is posed.
- The **discipline specific approach** involves knowledge and teaching skills that will improve the students' grasp of how they learn within a specific area. For example Feuerstein developed a program entitled Instrumental Enrichment in which there are specific instruments to teach problem solving and the interpretation of information. For example, in the instrument 'Classification' students are taught how to classify. This will aid them in all areas of the curriculum especially Science and Studies of Society and Environment (SOSE). In the instrument 'Organisation of Dots' students are taught to seek links through space. This actively develops their spatial orientation ability and will aid them in Mathematics and Technology.

- The **infusion approach** entails embedding thinking skills in specific subjects across the curriculum. All subjects can apply approaches such as The Three Storey Intellect (Bellanca & Fogarty, 1991) where teachers select learning tasks from three levels of complexity for their students. This infusion example allows for a differentiated curriculum within the classroom and thereby provides authentic enrichment and extension tasks for the more capable students and relevant, achievable tasks for all. For the infusion method to be of most value a whole-school approach is required. Once established, teachers and students will gain a high level of self efficacy and the capacity for conceptual change.

Leaders in the diverse field of Thinking Oriented Curriculum skills include:

Robert Ennis, Robert Sternberg, Ray Nickerson, Richard Paul, Edward de Bono, David Perkins, Robert Swartz, Reuven Feuerstein and Matthew Lipman.

(Source: Rexford Brown, *Schools of Thought*, 1993)

Individual differences

Important components of designing a Thinking Oriented Curriculum are ensuring there is understanding and providing for individual differences in learning. Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity.

Understanding learning styles and recognising individual differences in learning is a philosophy for improving student success. Every human has a distinct learning style! Learning styles research (for example, Gardner's Multiple Intelligences) helps teachers understand the factors that affect learning and they can then use this information to improve teaching and learning for all students. Teachers can select the best teaching delivery and resources for all students, including the most capable through to those at risk.

While realising that each learner has an individual blueprint and varying strengths, it is important not to label students as certain kinds of learners. Teaching strategies should nurture and develop all learning styles and areas of 'intelligence'. We also need to recognise our own strengths and preferences. For example, a teacher who has highly developed visual-spatial skills needs to be conscious that they don't forget to offer logical-mathematical or kinaesthetic content in their teaching delivery.

Teaching the skills of thinking leads to a self-regulated learner, one who can operate in adult society and think strategically, be self-regulated and reflective. The ability to collect, sort and analyse information can be taught in all Key Learning Areas. The classroom teacher, with the students, can choose what is powerful to learn. They can promote Higher Order Thinking Skills, use CoRT

skills, and recognise the importance of planning to incorporate specific thinking skills in their lessons.

Developing an innovative thinking curriculum model

Victorian Minister for Education and Training Lynne Kosky in her Framework for Reform speech, described the current Department of Education focus on Innovation and Excellence and the need to provide an environment for innovation. Innovation is a means to achieving excellence, and it is excellence which will lift outcomes and ensure parents that children in government schools have access to high quality teaching, engaging programs and a broad range of meaningful pathways (28 May 2003).

Again, early in 2004 (*The Age*, 5 January), Kosky made it clear that existing Curriculum documents would be re-worked to ensure students become independent learners and that the Government's aim was to ensure schools and teachers had more flexibility to cater for different needs of students:

At the moment in many cases they're [students] sitting in desks and learning set curriculum rather than learning for themselves. ... What we are wanting to do is have students do a lot more teamwork, a lot more work in the community ...

Many schools are now grouped in regional Clusters as part of the Victorian Department of Education and Training's Innovation and Excellence Project. This grew out of the Middle Years Research and Development (MYRAD) project (see Introduction to this text). Many schools, including mine, have a whole-school approach to the Thinking Oriented Curriculum as their Cluster focus.

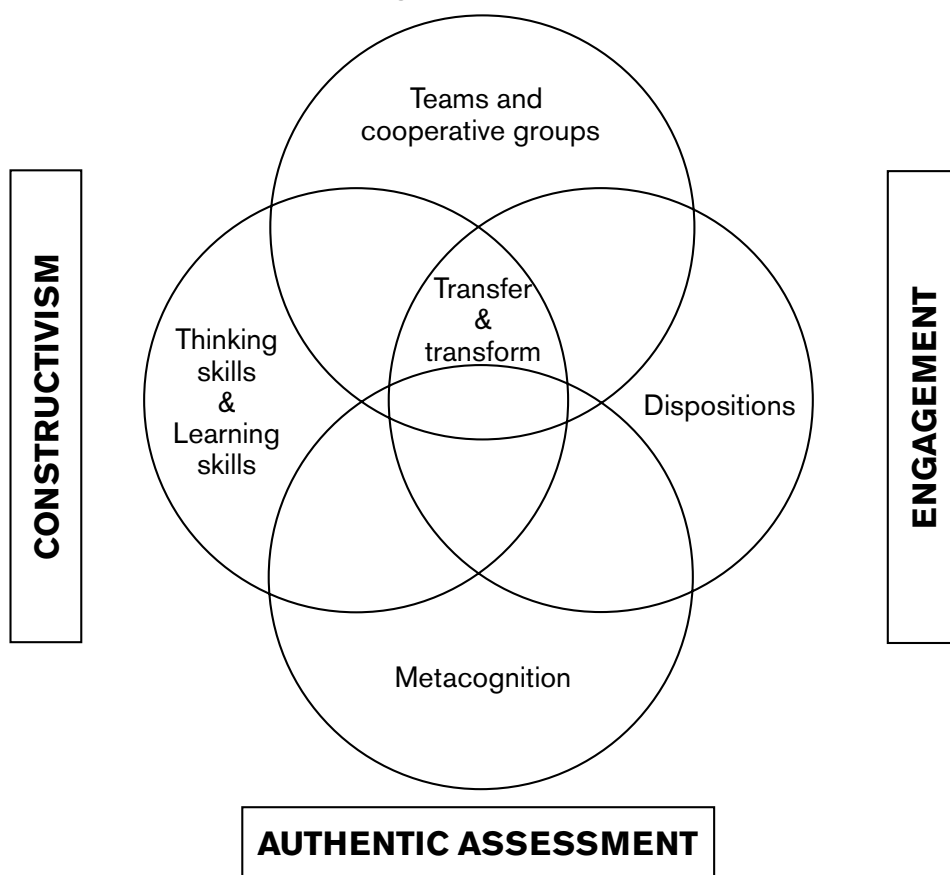
A whole school (and/or district) approach requires professional development of all staff so that a consistent core of knowledge can develop. A timetable that allows extended periods of time for sustained thinking to study topics in-depth is at the core of a thinking curriculum. A whole school (and/or district) curriculum that supports the development of thinking skills and embeds thinking and learning strategies in all subjects is required. Also helpful is the offering of special programs such as enrichment classes, the Tournament of the Minds program, cross-curricula and cross-school activities, teaming, inter-class debating, and so on. Professional learning teams within the school, encourage metacognition and reflection of teaching and learning.

Our school has three active learning teams. Each group consists of 7–8 teachers who are all timetabled off together for one period a week. This time is highly regarded and valued by school management and no 'extras' can be given to teachers in this time slot. I feel these groups within our school have driven school change towards the Thinking Oriented Curriculum. A positive environment and excellent communication with the parents and families of our students also supports the Thinking Oriented Curriculum.

We have developed a school model for a Thinking Oriented Curriculum. The diagram below represents our attempt to link together the key elements of a thinking curriculum. The ultimate aim in blending these main aspects is to provide a blueprint for the transfer of learning and transformation of the learner. The model below is used by our staff as a guide to ensure there is a consistent framework for teachers and students.

One of my areas of teaching is Materials Technology. I have designed and practised the following Thinking Oriented Curriculum Unit. This particular course is a popular elective program offered as a one-semester course in Year 10. This is an example of a Thinking Oriented Curriculum at the classroom level.

The Thinking Oriented Curriculum



This model was developed by Chris McGuire and Glenice Warner, Parkdale Secondary College.

Materials Technology—Textiles

This is a Technology Course designed for the Thinking Oriented Curriculum. In this Semester Course the students will be following four design briefs—each has a particular thinking skill focus. The Textiles room is well equipped and known as a thinking classroom by students. This helps to set the tone of the unit.

Teaching *for* thinking (the learning environment)

- Reward risk taking, active participation, self-expression and empathy
- Safe environment
- Access to technology
- Equipment
- Student ownership

Teaching *of* thinking (explicit teaching of thinking skills)

- Cognitive organisers—DATT tools, Venn diagrams and mind maps.
- Learning styles—Multiple Intelligences, JA quadrants, Higher Order Thinking Skills (HOTS).
- Dispositions—sensitivity, inclination, ability to engage in opportunities to think deeply.

Teaching *with* thinking (infused teaching of thinking skills)

- Opportunities to model, that is, structured experiences, exemplar of HOT skills in practice.
- Opportunities to practise, that is, student-centred, cooperative learning, reciprocal teaching, creative problem solving and problem based learning.
- Embedded assessment and routine feedback, that is, reflection, peer and self-evaluation, progress mapping.

Teaching *about* thinking (teaching thinking about thinking)

- Metacognition
- Self-talk
- Reflection
- Evaluation
- Automatism
- Transfer
- Mastery learning

Year 10 Design/Production

In the following description of the unit, the integrated thinking skills and strategies have been highlighted rather than the lesson sequence and scope. At the end of the unit description, the curriculum document requirement has been included.

1 Patchwork quilt

Quilting techniques, standards and labelling for doonas.

Explicit Thinking Skill: Three Storey Intellect for designing textile products for an end product.

2 Pencil case

Emerging fabrics, zipper application, and fabric testing.

Explicit Thinking Skill: PMI for zipper application.

3 Bag

Emerging fabrics, fibre testing.

Explicit Thinking Skill: Graphic Organisers, that is, fishbone for analysing fibre testing and Venn diagram for emerging fabrics.

4 Garment

Reinforcement of design/production skills/costings.

1 Patchwork quilt

Design Brief: Create a quilt using recycled fabrics using the puffed patchwork technique plus two different decorative techniques. The quilt can be of any size but needs to be aesthetically pleasing.

Explicit thinking skill: Feuerstein's Instrumental Enrichment—organisation

There are excellent exercises for improving spatial orientation, critical for pattern making. The language of thinking is introduced. The teacher's role is as facilitator.

Thinking skill focus: Three Storey Intellect

How is designing a quilt a process which involves thinking? Consider the end product, specific uses, aesthetic and market qualities.

Peer assessment of each other's samples. What are the difficult practical concepts here? How can we improve and safeguard our product as we work through it?

Investigate three types of doona on the market. Why is there such a range?

Homework: Select from the Three Storey Intellect model one higher order thinking skill and pose two open questions to share with class next week relating to your quilt?

Analysis of production.

Assessment criteria.

Design sketch.

Students to present individual quilts.

2 & 3 Pencil case and denim bag

Design Brief: Using two different emerging fabrics create two different bags for different purposes. One of the designs must demonstrate the application of a zipper.

Students are not given a pattern but need to design their own. The focus is on using fabrics with which they are likely to be unfamiliar.

Thinking skill focus: de Bono's PMI and graphic organisers— fishbone, Venn diagram, concept mapping

The teachers model the above while presenting the introductory lesson.

4 Fashion garment

The type of garment produced will depend on the student's ability level. With the constraints of time students should be encouraged to choose a simple garment, which results in success, and that the student would like to wear!

Thinking skill focus: chosen from previous components.

Curriculum Learning Outcomes requirements:

a Analyse the appropriateness of using particular materials for specific purposes.

This is evident when the student is able to:

- demonstrate an understanding of the role of quality and control standards including those of the Australian Standards Association,
- describe two emerging materials and their characteristics, and
- describe, with reference to a range of factors, appropriate materials for three specific products.

b Prepare detailed design proposals, make products using complex equipment and analyse the effectiveness of the products with reference to specified criteria.

This is evident when the student is able to:

- select, apply and vary the sequence of phases of the technology process to suit different problems,
- use a variety of suitable techniques to generate a range of detailed design ideas,
- test materials to determine their suitability for a specific purpose,

- apply knowledge of factors that affect product design, such as function, aesthetics and cost,
- work independently and safely, using a range of complex equipment to produce solutions, and
- analyse products with reference to specified criteria and explain the effectiveness of the products.

Assessment focus:

- Designing
- Investigating
- Producing
- Evaluating

Conclusion

One needs a certain amount of professional courage to provide a Thinking Curriculum. However, as leaders of change, teachers can be encouraged to promote a learning environment rich in opportunities of thinking. Rexford Brown (1993) stated that the greatest barriers perceived by teachers, and the major reasons schools did not move towards a Thinking Oriented Curriculum, were as follows:

- It was seen as too time-consuming (to implement, plan, evaluate, professional development requirements and so on).
- There was a false belief that the complete coverage of every facet of the prescribed curriculum was required.
- The belief that most students don't have the intelligence/literacy levels to promote thoughtfulness.
- Most students were disengaged.
- Teachers did not know what was necessary to bring about change and did not perceive themselves as learners.
- A belief that thinking skills could not be evaluated.

None of these dot points can be defended if one considers the needs of our students today.

The major implications for teaching a thinking curriculum today are that, in doing so, we:

- create learners who engage in metacognition,
- provide an environment where students find connectedness with significant adults,
- provide mentoring that would help them achieve better results and an attitudinal improvement to learning,
- create life-long learners,
- assess learners developmentally so that education is less about competition with others and more about reaching individual potential, and
- differentiate the curriculum to cater for all students.

The more students believe their school (specifically the teaching staff) is emphasising thinking and learning strategies, the greater their motivation, and the more focus they will have on the perception that they are in control of their learning. They will hopefully see their teachers concerned more with individual ability and less with competition. This will help them understand that their school is guiding them to be better learners. They will value the journey that is the process of learning and in doing so make the sequential development a much richer and meaningful experience.

Designing a Thinking Oriented Curriculum at a classroom level is as important as in a whole school, district or statewide. The emphasis should be on classroom and curriculum designs that promote critical thinking teachers and students and where teachers develop their role as facilitators of learning rather than as experts.

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Discrimination

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Testing everyone?

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Substituting a narrow, skills-based approach for a dynamic, child-responsive curriculum will rob young children of the joy of discovering how much they learn and just how fulfilling school experiences can be (Hatch, 2002, p. 459).

Abstract

If we examine the activities and assessment tasks we set for our students, many of us would find we give fewer opportunities for the students who are skilled in areas other than the verbal and mathematical domains to experience success or satisfaction. Generally speaking, the critical thinking skills developed in the Arts and Technology (Materials, Systems and Design), as well as the advantages of possessing an aesthetic mode of knowledge, tend to be undervalued. It is difficult to assess and reward visual perception using traditional models of evaluation that exist in current systems. In this chapter examples of attempts to test visual literacy are considered. Some existing restrictive and/or flawed test questions are examined, and simple changes and some new examples are suggested. A discussion of the benefits of authentic assessment follows.

Introduction

In 1969 Arnheim, the US art educator, wrote that, apart from in kindergartens where the children were encouraged to invent shapes on paper or in clay and think through perception, their educational system was based mainly on the study of words and numbers. He claimed that because words and numbers were stressed more rigorously from Grade One onwards, the arts were reduced to a 'desirable supplement' (1969, p. 2). By the time competition for university places became acute, he concluded, it was a rare high school that insisted on the preservation of the Arts. He also claimed it was a rare university that welcomed the inclusion of visual arts. Unfortunately the same could be said today.

The neglect of the arts and the undervaluing of visual literacy and the creative process results from a prevailing assumption that affective perception

does not involve deep cognition. Arnheim believed that educators and administrators would not give the arts an important position in the curriculum until they understood that the arts were a powerful means of strengthening the perceptual component of thinking, without which productive thinking in any field was impossible (1969, p. 3).

Second year students completing a component called Philosophy in Education with me, were asked to read a chapter from Eisner's text *The Kind of Schools We Need* (1998). In this chapter he put forward an argument for valuing aesthetic modes of knowing. The comments he made on the status of the visual arts in schools echoed Arnheim's description 30 years earlier. When groups of students assembled to elicit the five main points of the article some made comments such as: 'I read this over and over again and couldn't make sense of it'; 'I couldn't understand a thing he was saying'; 'What does aesthetics mean?' Given the above, such questions and comments did not surprise me. But a lone voice said: 'Why are we reading this, it's common sense, it's what happens in schools isn't it?' I will return to this remark later.

So what was Eisner (1998) saying in his chapter that was so foreign to the students? He claimed that Plato's view that knowledge could not be relied on if we depend on information provided by the senses has had an enduring effect on conceptions of both knowledge and intelligence. To be intelligent is seen as the ability to move away from our senses and manipulate ideas in the same way abstract concepts are employed in mathematics. Then, he says, further down the perceived 'hierarchy' come the natural and social sciences because they depend on empirical information. Even lower in rank are the arts and making things, particularly if emotion enters the picture (pardon the pun). At this level people are described as *talented* rather than intelligent. In 2000 Gardner, presenting a paper in Melbourne, lamented the use of the 'talent', rather than 'intelligence', for those skilled in the fields of art, design and music.

Does the dearth of the aesthetic in the curriculum teach students that we do not value it? There are endless opportunities if teachers know where to look.

In a history method class, I recently asked some postgraduate student teachers (high achievers by most standards) to sketch a prominent person. They were embarrassed and ashamed of their sketches that were roughly equivalent to fifth graders (11 year olds). I think the sketches offer a snapshot of a gap in their education. Why aren't their drawing and writing skills equally honed in their 15 plus years of education?

Faulty testing?

Since the progressive education movement in US in the 1940s (Barzun, 1945) writers have been concerned about the limitations of tests that relied on cognitive learning. Objective, computer-scored tests ignore whole areas of a student's intellectual make-up. The non-verbal capabilities—the speculative, intuitive, creative, abilities are harder to assess and therefore tend to be neglected. Eisner

(1998) made reference to the Scholastic Aptitude Test in the United States that focused on testing verbal and mathematical aptitudes. This sounds roughly equivalent to the core skills test administered to Year 12 students in Victoria (General Achievement Test—GAT). His point was not that these skills are irrelevant, but that ability in these areas is considered to represent what we need to know about a person's mind, knowledge and ability, leaving the aesthetic to become the casualty of education.

To what extent is visual literacy assessed in General Achievement Tests (GAT)? Are the examples below representative of the weak attempts to incorporate assessment of aesthetic forms of knowing?

Example one

Students were asked to examine a cartoon and choose the 'correct' interpretation of its content from several offered. However, its meaning was not clear—a lateral thinking student could offer a good reason for any, or all three, of the options as a reasonable response. Do the students try to guess what they think the assessor thinks is the right answer?

Example two

A self-portrait by Van Gogh was presented in full colour and therefore offered an attractive stimulus for visual interpretation. However, the students were asked to read a Fine Arts academic's jargon about the work, that is, someone else's interpretation, prior to choosing the correct option. What is being tested here was the students' ability to read a 'writer's' interpretation rather than their interpretative skills.

There is nothing gained in educational terms by setting tests that ask students to guess what is in the examiner's mind rather than respond personally and naturally to a stimulus. The marks gained in such an exercise are not an accurate assessment of a student's knowledge or ability.

Given that assessors do read other essays written as part of the General Achievement Test, it should be possible for them to also read the students' personal responses to an artwork, or better still, their reaction to this visual stimulus or other contemporary prompts, via their own illustration. Both could be assessed according to criteria like the presence of imagination, flexibility, fluency, elaboration, association and sensitivity. I also question the use of images from history when contemporary images that might engage the students could be used instead.

Eisner (1998) described teaching he had witnessed as being broken into units of instruction, in other words, fragmentation with each fragment taught and immediately tested in the belief that what the students know is captured and they can be given unambiguous feedback. This kind of testing does not assess deep knowledge and understanding, substantive conversations, or meaningful learning. He called for a return to 'the joy of the ride' (1998, p. 41) with

students satisfied by the inquiry. Patrick White, winner of a Nobel prize for literature, expressed the same sentiment during an address he delivered at Monash University just a few months before he died. He described us as having lost the ability to appreciate beauty around us—such as a scarf fluttering in the wind. Eisner asks how we might design tasks within a field of study so that inquiry in that field provided aesthetic satisfaction. There is another connected question: how might we design tests that give students with strong visual and perceptual skills the opportunity to score well in general achievement tests?

Current emphasis on multiple intelligences and authentic assessment associated mainly with the Middle Years' movement is encouraging teachers to think broadly about what and how they are assessing. The designers of general achievement tests need to change their emphasis if they wish to cater for all styles of learning and multiple talents.

It is not difficult to see why the second year Bachelor of Education students found the concepts in Eisner's paper foreign. They are products of the education he described. But what of the lone voice? Why did she think what Eisner said was common sense and common practice? When being prepared to sit the stimulus response paper (one of the Queensland's Core Skills tests), her teachers prepared the class's aesthetic knowledge. They used to practise analysing visual and verbal stimuli. She remembered that her history, politics and economics teachers frequently required students to apply their knowledge by interpreting artworks, photos and cartoons.

However, General Achievement Tests, even when requiring visual interpretation of illustrations and captions, require a written response. Students with strong visual perception, good aesthetic understanding and excellent illustrative skills often have weak verbal and written skills and are therefore still at a disadvantage.

Example three

A General Achievement Test (again from Queensland) contained an opportunity to test students' ability to analyse and interpret Manet's *Un Bar Aux Folies-Begere* (1882) and the Australian John Brack's *The Bar* (1954). This required a close examination of content in order to answer specific questions.

I decided to test myself. As suggested by the test, I selected from the choice of responses provided, the answers I thought were correct. Having analysed and interpreted the paintings I selected answers and could justify and give reasons for my responses. However, although I have a major in Fine Arts and my PhD research was related to aesthetic inquiry, according to the examiners most of my answers were 'wrong'.

The problem for examiners is that such questions require engagement in discussions. I imagined a conversation with the examiner who determined the 'correct' answers, in which we looked again at the works and tried to understand each other's point of view. This is a great strength of using the visual arts as the

subject of a discussion—the presence of the work permits checking any point of argument. We could compare and contrast the reasons for our responses—and perhaps change our mind on considering new information. That is the process involved in sound aesthetic inquiry.

The value of using two works for students to consider is that it does not necessarily require prior knowledge. Each individual can take to their examination of the works any knowledge they have of bars, bar attendants, bar crowds and perhaps background knowledge of Manet and/or Brack and their work. Unfortunately, in the test, there was no space provided for students to justify their interpretation, and there was only one answer allowed. Surely, there is a flaw in tests that require one to select from a range of value-based answers. When asking for interpretation and analysis in art (and other subjects), there is not necessarily one right answer, or even ‘a’ right answer. The opportunity to give reasons for one’s choice should be an integral part of the test.

The choice of two similar works like *Un Bar* and *The Bar* is a sound method for comparing and contrasting artists’ styles, aesthetic qualities, and social and cultural approaches. It is a method that can be used effectively without dependence on historical and theoretical background knowledge. Further knowledge about the works can be answered by later reference to texts. When using this approach, examiners would rarely say that a student’s reasoned response was wrong. However, scores could be assigned according to reason, affective response, creativity and so on.

Wishing to create a test containing a balance of questions for students with different learning styles and strengths, Iser (2004) audited past tests and invented new questions. She wished to avoid the pitfalls described above. Below is a selection of questions she included in a test for Year 7s. Note the questions and activities are open, requiring interpretation by the students with opportunities to be both critical and creative. Her criteria for awarding marks covered higher order skills, for example, analysis, synthesis, reasoning, justifying and so on.

Question 1

If you could make a medicine that changed the way people behaved, what would you make the medicine do to people?

Why would you make a medicine that did this?

Question 2

A new planet has been discovered. You have the chance to ask an expert scientist three questions about this planet. What would you ask?

Write down three questions.

Question 3



... and suddenly the ugly prince turned into a beautiful frog.

What is the bigger frog trying to tell the smaller frogs in this cartoon?
(Source Australian Council for Educational Research, CSTP, *Sample Questions*, Vol. 2, p. 26, Q. 20)

Right reasons for wrong answers?

While contemplating the issues discussed in this chapter, an article by Chervin and Kyle (1993) came to mind. They described their analysis of the results of multiple-choice written tests administered to a group of Year 3/4 students in Montreal and contrasted this data with the children's characteristic performances in oral class discussions. Discrepancies led them to believe that the reasoning skills demonstrated in written tests only shed light on one aspect of the students' abilities.

Believing there was a need for a range of instruments to study the same students in a dynamic oral setting and thus provide a more complete assessment, they chose three types of data gathering instruments: multiple choice written tests, interviews, and an observation checklist. They reflected on whether they should be asking the students what they really meant by each of their responses in the interviews. They found that each of the four interviewers assigned different possible meanings to the students' responses. They realised that what was important was not the possible or intended meanings of the students, but rather the possibility that a given student's meaning was ambiguous and could be read in different ways.

Of major significance was their realisation that, like, for example, the General Achievement Test, the tests were being marked as though there was only one answer to questions and only one interpretation of a student's answer. These concerns pointed to the possibility that the researchers would focus on

what they judged was the 'right' answer and thereby miss other possible readings of student responses (Chervin & Kyle, 1993, p. 19). The wider implications of this point for classroom discussions are also interesting.

Chervin and Kyle's findings led them to 'read for plausibility' the students' responses to test questions. They found they were eroding the authority of the standard test with each new discovery—particularly because students could be justified in disagreeing with 'right' answers. The testing was not crediting students for either their abilities to reason with high degrees of subtlety and complexity (1993, p. 20) or many other skills they possessed.

The significance of these findings was that students might have good (defensible) reasons for 'wrong' answers. They showed they were capable of an unexpected dextrous use of modalities. This 'unexpectedness' may have been due to teachers' mis-characterisation of student thinking which they had restricted by relying on predetermined categories. The consequence of their discoveries was a re-examination of the data containing the students' subtle use of modalities, for example the students' meaning of phrases like 'must have' (must've) was 'likely', not 'essential'. At the very least, this use of modalities by children raises important questions about the plausibility of their choice of answers other than those considered to be correct by examiners (Chervin & Kyle, 1993). Their findings revealed the need for accurate assessment of students when their meanings are being sought.

Authentic assessment

I should clarify that I believe that tests that assess the application of acquired knowledge and skills, so long as they are valid, offer a better way of assessing a student than most models currently used. In fact, as a university lecturer, I would prefer university entrance to be based on performance in a valid general achievement test that assessed reasoning and applied knowledge rather than the current Year 12 exams. Naturally my concern about the lack of opportunity for visually literate students to show their understandings and 'talent' remains.

Depending on the country or state in which one teaches, there is either an emergent or already prevalent (in some states in the US, almost crippling) emphasis on mastery of learning supposedly exhibited by scores on tests. This is often considered undesirable by students and teachers because they perceive an absence of meaning. Emphasis on testing is known to lead to low levels of engagement (Newmann, Scada & Wehlage, 1995). Despite national, state and local mandates, educators need to remember that assessment is primarily the process of gathering information about students, not sorting or grading. Tests are only one form of assessment. Assessment entails demonstrations, oral and written presentations, performances, contests, projects and problem solving projects. Here are three types of authentic assessment:

- 1 **Naturalistic**—teachers observe students during everyday learning activities and systematically collect information that can be used for later analysis.
- 2 **Performance assessment**—teachers observe students in the performance of a skill or task in response to a set of directions, for example, science experiments, programming a computer, designing and building a product, writing a script, playing the flute, contributing works to an art exhibition.
- 3 **Portfolio**—students collect samples of their work as evidence that they have met specific learning objectives. Usually they write a rationale for their choices.

Note: See Chapter 2 of this text for Brown's model of Reflection and Assessment based on a unit of work.

Problems with emphasis on 'standard' testing

Hatch (2002) described the ever-increasing emphasis on 'standards' being applied as low as early childhood education in the USA, for example, 'By Grade One, each child will (spell x words, know y tables, calculate z)' and so on. He stressed that emphasis on standards at the expense of developmental readiness, and outcomes at the expense of curriculum, has undesirable effects and dubious educational value. I think his work is worth paraphrasing here.

Over-emphasis on standards can mean that:

- Students are put under stress—they will not achieve their best in these circumstances.
- Teachers are put under stress because the broader domains of student's development are sacrificed for overemphasis on narrowly defined academic standards.
- Curricula are reduced to emphasising the content on which students, teachers and schools will be assessed.
- Accountability is based on the premise that students and teachers will not work hard unless they are afraid of being found to be below 'standard'. Using the threat of failure as a motivation tool is absurd because some children, particularly those 'historically short changed by the system' (Bohn & Sleeter, 2000, in Hatch, 2002, p. 459), will not meet the standards.
- Teacher opportunities to make decisions based on their professional judgment are reduced. The implementation of standards-based programs implies that teachers are not to be trusted or respected.

- Students value the attainment of objectives over their ability to learn. If performance goals, rather than learning goals, dominate learning, then school tasks will have no intrinsic value for students.
- Imposing common standards that ignore individual differences and assume knowledge is unrelated to the knowledge-seeker and can be delivered without regard for individual needs and interests.
- Those who are making the decisions are those with cultural power to decide which knowledge has the most worth. Students already excluded from access to the resources will be further marginalised because they are expected to perform at prescribed levels based on the false assumption that equal opportunity exists. Standards-based models promote sameness and punish diversity.
- An unwillingness to change because it takes small amounts of money to develop tests but large amounts to achieve significant change (Apple, 1996, in Hatch, 2002). There is little empirical evidence of causal links between setting standards and student learning (Nave, Miech & Mosteller, 2000, in Hatch 2002).
- Teachers trained and committed to educating students are being dictated to by politicians or individuals driven by a corporate mentality.
Teachers view students as complex and in need of guidance and nurturing, not ‘commodities that must meet standards of production’ set by narrowly defined outcomes (Hatch, 2002, p. 461). New thinking curriculum theories and middle years’ research are offering appropriate ways of improving programs and maintaining student engagement (see Newmann, Secada & Wehlage, 1995, a foundational text in this area).

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Million Tears

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The visual arts as a thinking tool

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Abstract

Since research on the middle years was released (Hill & Russell, 1999) and state curriculum documents began to focus on essential and authentic learning based around productive pedagogies rather than focusing on Key Learning Areas, curriculum structures and teaching approaches have begun to focus on the development of thinking skills. Thinking about artworks, and discussion of controversies associated with art, can be used by teachers to help their students extend their thinking skills while at the same time fostering the examination of the complex relationships that exist between people, cultures and artefacts. As part of my research and work as a teacher educator with art and generalist teachers I have formulated strategies and collected resources that, alongside art making, can be used to engage students and develop their analytical, conceptual and perceptual skills and understandings. Some are described below.

The visual arts in society today

Today, optimists describing the place of the Arts in society can point to increased attendance at galleries, performances and museums, renewed interest in artefacts due to archaeological digs, and multi-cultural awareness creating greater acceptance of different art styles including graffiti and street art. In exemplary classroom teaching, techniques that equip students with broader and more critical attitudes are creating acceptance of art styles and demonstrating that art is not a 'soft' option. Appropriate art curricula have an expectation that students will be conversant with the past, with diversity, and will be able to make and verbalise meaningful judgments about works. Where visual arts teacher-training courses survive, art method, curriculum knowledge as well as the psychology, history and philosophy of art, are included alongside making.

Unfortunately, another viewpoint, often referred to by art teachers attending my professional development sessions, is that their school personnel view the visual arts as:

- of lesser cognitive significance than other subjects,
- time fillers without serious standards,
- cognitively undemanding and/or difficult to assess,
- talent-based and not transferable to the world of work, and
- a matter of taste, therefore there is little point in questioning personal values.

As a consequence, they say, curriculum time for the arts is reduced when finances are squeezed.

Although the visual arts, properly taught, encourage multiple solutions to problems, prize innovation and imagination, and rely on the use of judgment and sensibility, they are not necessarily viewed as worthy of having equal status with other core subjects. One would think, given the importance of imagination for remembering and creating new images, that the contribution of the visual arts would be regarded as one of the basics of education and integral to other learning areas.

Art educators can facilitate critical understanding

Whether from the perspective of maker, historian, aesthetician or critic, creative and imaginative thinking are instances of higher order thinking and involve both intellectual and intuitive dimensions. Skills like originality and imagination are valued in applied science, so why not the visual arts? Showing the detractors of the visual arts a list of thinking skills like that below—created by Boyd (1994) and rearranged by Abbott and Wilks (2000)—although neither exhaustive nor exclusive to the visual arts, is one way of arguing for the cognitive benefits of the visual arts.

While modernism emphasised the development of personal meaning, it did not necessarily emphasise cultural, historical and theoretical frameworks. The postmodern movement's acknowledgment of the cultural context has changed the way the activities of artists and performers are conceptualised. When investigating the relationship between art and culture, new insights into the meaning invested by the artist/performer in the works themselves and which form a language of symbolic imagery are required.

Thinking and process skills developed when making art and discussing artistic problems and related issues

Art making	Aesthetic perception	Evaluative reflection
discovering	observing	reviewing
producing	selecting	criticising
designing	visualising	reflecting
manipulating	applying knowledge	comparing
experimenting	[e]valuating	analysing
imagining	hypothesising	contextualising
risk-taking	discriminating	assessing
organising	validating	appraising
predicting	adapting	
deliberating	refining	
inventing	intuiting	

The ideas present in the visual arts today require the observer/participant to engage in dialogue, reflection, imagination or metaphor—that is, use other forms of communication—in order to make connections and understand issues.

The teacher's role as provoker and facilitator of inquiry into contemporary art is important here. It is no longer sufficient to delve into artists' backgrounds and intentions, or to ponder why certain colours work or fail to inspire individuals. Teachers can use examples of contemporary art that provoke their students to explore issues and deepen their thinking. Topics that provoke discussions where controversy is inevitable, and artworks that can be used to support points of view are easily found. For example questions such as:

- If we appreciate different artworks from our grandparents, does it mean that we are imprisoned by our generation?
- Does/should being uninformed stop us from evaluating artworks?
- If particular works in an exhibition at a Jewish Museum are viewed as offensive and upset visiting Holocaust survivors so greatly that they weep, should their pleas to have works removed be acted on? What if the curator's aim for the show is to create discussion of the issues?

Both teachers and students need to become confident enough to ask questions to which there is no definitive answer (as opposed to using closed or leading questions). The middle years' literature (for example, Braggett, 1997; Newmann & Wehlage, 1996) recommends placing stress on active learning, collaboration, authenticity of learning and assessment, community, and integrated studies.

According to Greene (2001) this represents renewed engagement with Dewey's work. Philosophical inquiry (See Chapter Two) is a good model to employ to achieve the above.

Art in the postmodern era

Some negative societal attitudes have been caused by both 'public' ignorance about contemporary art and a perception, perhaps partly accurate, that artists and curators are purposely obtuse or arrogant. Peter Timms, an art critic, raised the following issues, paraphrased below, about contemporary art:

If anything can be art, from a fuzzy home video or a transitory performance, to a plank of wood, then is there meaningful conception of what constitutes good or bad art? Many impenetrable catalogue essays appear to be designed to patronize rather than inform. Is the only real measure left who is hot and who is not? It is easy to form the opinion that the point of much contemporary art is not to clarify complex ideas, let alone give them aesthetic dimension, but rather to make simple and familiar ideas opaque. People might dismiss the contemporary arts arguing that if they can't communicate, they are unworthy of support or interest. (*The Age*, 25 October 2001).

However, an overwhelmingly positive public reaction to the opening of two new art museums in Melbourne in 2003 (Australian Centre for Contemporary Art and the Ian Potter Centre) demonstrates that public perceptions are changing. Both curators and artists are inviting exploration of works rather than preferring to remain obscure or elitist. Unfortunately many in their audience, including some teachers, do not have the conceptual tools to unravel the works.

Teachers who understand postmodern perspectives understand that ideas from the past and present, popular and high art, and the art of all cultures, can sit comfortably together. The idea of the original has been superseded. According to Stewart (in Errington, 1993, p. 186), new understandings of the aesthetic, such as those paraphrased below, should be incorporated into their teaching. These ideas include understanding that:

- former styles are recycled as a way of interpreting the world,
- eclectic processes comment on past art forms,
- viewers construct personal meaning when viewing works,
- individuals are shaped by history and culture, and
- responses to a society characterised by consumerism, the power of technology, and economic rationalism, are reflected in artworks.

A broader conception of art: a celebration of thinking and dialogue

If street art, graffiti and multi-media are integral to our lives, then should we also wonder whether it is as important to indigenous peoples? Chalmers (1981) said the skills students require are more like those of anthropologists, who make connections between their own experiences and that of other cultures, and ethnographers, who reflect on their own cultural experiences to understand their own lives.

Particularly in the primary and middle years of schooling, there is an enduring pre-occupation with art making. Teachers claim that making is what their students expect, and there is not enough time to have lengthy discussions. It appears that many don't know how to help their students describe, interpret or evaluate images in depth, and have not experienced the engagement of their students in a prolonged, even heated discussion.

Imagination is essential for self-expression and is promoted by reflective participation in considering topics such as what constitutes a work of art—a major topic in Aesthetics. This topic can be raised simply by questioning whether what the elephants in Thailand produce on paper, when given a paintbrush and paint, is a work of art. Alternatively, there are often newspaper articles describing how a cleaner mistakenly threw out an artwork, or by a journalist claiming to be able to produce a better artwork than the winning entry and so on. For many years teachers have reported how successful Lipman's exercise (1976, abridged below), which requires an interrogation of objects, has been in evoking an enthusiastic discussion.

What is art?

Suppose that your family is about to move. When the removalists arrive, you are the only one at home. The removalists ask you to point out any works of art so they can take special care when packing them. Your problem is—how do you tell art from non-art? Suppose you encountered the following, how would you classify them—art or non-art—and why? Be prepared to give reasons for your response.

How would you classify:

- your sister's earrings
- the family car
- the framed reproduction of a Van Gogh painting
- the bookends you made at school
- your best set of dishes
- the kitchen sink.

Socio-economic, gender and ethnic distinctions apply to understanding and considering each of the six examples. This becomes part of the discussion, as does the offering and refutation of points of view and the analysis of terms like ‘reproduction’. Guided by the teacher, students will need to consider criteria for considering something a work of art—is there any agreement? This will require fostering the cohesion of a group so individuals are confident enough to offer opinions about contentious aspects of the works. The thinking curriculum requires a shift in focus from the teacher as expert and fount of knowledge to that of facilitator of student inquiry. Although easier for some teachers to achieve than others because it requires teachers to retreat from playing the expert’s role, facilitation requires them to find ways of encouraging more student talk. Resources and activities that raise questions about situations and objects that are value laden or controversial are vital as student engagement is the first requirement.

Having students responding to one another’s ideas rather than discussions being teacher-centred requires the creation of a supportive environment that will encourage student participation. For example, using questions such as Does anyone disagree? Is that always the case? Can someone add to what Jix said? encouraging the student to speak means the teacher is less likely to do the talking for the students. Also, waiting a long time for students to respond after a question encourages the slower (perhaps deeper) thinkers to contribute to the discussion. Teachers constantly refer to ‘new’ voices that have emerged as a result of waiting. It also means being brave enough to encourage, not suppress, discussion of controversial issues as they emerge, and not appear to be after the ‘right’ answer, but rather appreciative of the processes of wondering and reflection. Both teachers as models, and students as participants, should want to listen to different views and understand there are reasons for beliefs that probably need to be examined.

Guided and direct learning experiences like the examples above help students see details and relationships in artworks as visual and cognitive responses to the environment. Guided experiences are those in which someone or something intervenes between the student and the subject under consideration, for example the guidance given by Perkins, 1994, when describing reflective intelligence.

A. Slowing looking down

- Resolve to look for a good while, that is 3–5 minutes.
- Let your eyes work for you—your experiential intelligence will seek meaning.
- Let questions emerge—seeing puzzles that might get resolved later is an important part of experience.
- When the flow stops, look away and look back. As you look again you will re-see features with more familiarity.

B. Making looking clear and deep

- Go back to something that surprised you—ask why the artist did that, was there a message, how does it fit into the whole work?
- Look for something that puzzles you about the work—try to unravel it.
- Think about how the work functions to control your thinking.

Folk and indigenous artistic traditions and the values of popular culture can be incorporated into visual arts education in order to make connections between these genres, the fine arts and making. Digital photography and computer-generated images confront us with new questions about virtual reality. Dealing with these issues has become as important as understanding texture in paintings (Stewart, in Errington, 1993).

The visual arts are linked to social theory, archaeology, cultural history and the postmodern theories that are redefining the way we understand ourselves. The social functions of images, for example narration and persuasion, can be explored by asking questions that probe issues such as: Who should choose public art? and What criteria would be appropriate? This latter question relates to the public furore that regularly erupts over the choice of new acquisitions paid for out of the public purse. Themes like aesthetic taste can be explored—historically, cross-culturally and visually—by examining challenging works like Peter Corlett's *Connoisseur II* sculpture (The Ian Potter Centre, Victoria).

Introduction

Corlett said it made us confront our own body image. How embarrassing! You know he is a real person, he lived around the corner from the sculptor. We used to chat to him at the local milk bar, talk about the footy and tell jokes. He was also a connoisseur, of many things: wine, art, and antiques. What made him do it? None of us could imagine ourselves modelling for this type of sculpture—we were all too fat, too wrinkly or down-right ugly.

Shouldn't sculptures be beautiful, like Rodin's *The Kiss*? *The Connoisseur* was confronting in his nakedness. Even his y-fronts were embarrassing. They reminded us of our dad. We all agreed that we wouldn't have had the gall to pose for such a public image.

Questions

Why had this man done it, did he not care that he would be on public display? What would his neighbours and children say? Wouldn't he be embarrassed that people would recognise him and make fun of his fat belly?

This sculpture is one of the most popular artworks in the The Ian Potter Centre. How can this be—aren't artworks meant to be uplifting?

What do you think makes an artwork popular? Who should decide what is displayed in a gallery or a public place?

What makes this work confronting?

(Source: Susan Paterson, La Trobe University, Bendigo, 1994)

The giving and hearing of reasons for opinions becomes an important facet in the exploration of art. Viewing and discussing the art and learning from this process aid the advancement of understanding, taste and higher order thinking.

The young can handle discussions about, for example, whether a house with the etched face of Pamela Anderson on its façade (Canterbury Road, West St Kilda, Melbourne) is architecture, art, or something else. The following is an extract from a discussion by Year 5/6 children from a Melbourne primary school about the house:

I think it's art because it may just be a house, but not everyone's house has a supermodel on it.

I'm not sure if it's art or not because the photography is art but you can't be sure if the house is until you've been inside.

I'm not sure if it's art because the house is not, but the tiles are.

I think the house is art because someone has lined up the photo uniquely.

(Wilks, 2001).

Teachers can use students' diverse traditions of theatre, puppetry, magic, story telling, graffiti, hip-hop (is it dance or music?) as a means to engage them in dialogue that stimulates the making of meaning. Expressing ideas through symbols, and learning to read/decode the symbols of others, means we develop sensory awareness and perceptions that are valuable tools in the total educative process. The arts represent a valid way of knowing and perceiving, and artistic intelligence is one way meaning is developed (Greene, 2001).

The role of the visual arts in the integrated curriculum

Programs in the arts (at least in Canada, the USA and Australia) are losing timetable space because of the emphasis being placed on ‘literacy’, technology, basic skills acquisition, and testing (Brown, 1993). But, as art educators begin to defend the rightful place of the arts in school programs, schools must acknowledge the importance of the development of multiple forms of literacy. The newly emerging Thinking Curriculum in Australia—particularly the emphasis placed on learning teams and the integration of tools like Bloom’s higher order cognitive and affective thinking categories and Gardner’s Multiple Intelligences—is providing a platform for change.

Because examining people’s beliefs, values and lives is a means of understanding the world, integration of the visual arts across the curriculum should be a given. Primary teachers, already used to integrated curricula, could spend time having their students create, as well as discuss, images and then have them write about these images—historically, cross-culturally and in terms of their own experiences (Stewart, in Errington, 1993). Teachers of junior secondary classes may have more trouble with this approach given a previous emphasis on making and lack of integration of subject areas and, to a lesser extent, grouping students to work as learning teams. However, current ‘literacy’ requirements and middle years’ theories might help to foster acceptance of the above.

Middle years’ literature advocates the alteration of timetables, curricula, teaching strategies, assessment modes and the making of connections with the school community. It requires teachers therefore to ask themselves questions such as:

- What is important to teach and learn? Would the students agree?
- How can we ensure it occurs so that both teacher and students are engaged?
- What kind of support is needed? (resources, administrative, community)

Authentic education

Learning does not occur in self-contained episodes, but results from a montage of information gathered from family and friends, experiences and discussions. Collaboration with classroom teachers means additional art activities can take place outside the art room. Taking an interdisciplinary approach to teaching, not fragmenting subjects for fear that they will not otherwise survive, means art will still be taught and art concepts will be stronger because of the connections. Giving artistic shape to concepts, whether they are from science, mathematics or society and environment, adds meaning, for example:

- mathematics can be found in the Pyramids, Renaissance perspective, architecture, dance and musical notation,
- science is in the exploration of impressionism in all fields, Kandinsky, movement and the paint of aboriginal artists, and
- values, history, and aesthetics can be understood through examining the arts of cultures.

Viewing the requirements of current curriculum and assessment as a challenge, rather than a burden, is difficult but necessary. Teachers are expected to include mathematics, technology, and literacy in all curriculum areas, as well as apply state and national standards. Not worried by these requirements, one middle years' art teacher had the following statement pinned up outside her classroom:

My mission is to provide a creative, safe and artistic environment so that our students can learn all subject areas through the arts.

She was using an African theme across all year levels. The students were working towards a production. They had listened to many African stories and written their own. Their story was sent to a member of the State Orchestra who put it to music. A choreographer was then booked to work with the students to create a performance that responded to both their story and the music. Other members of the class and community would make the costumes and sets. The performance would be the day of the school's Art Exhibition. This teacher's examination of ethnically and geographically interesting artworks was expanding knowledge and altering opinions.

According to Wolf and Balick (1999) the skills built in art rooms like this include the ability to:

- work in teams collaboratively,
- use imagination and creativity to solve problems,
- articulate design ideas and styles, understand cultural contexts, and
- work within parameters when necessary.

These are the skills that have relevance in the real world and which will not be built by placing emphasis on basic skills acquisition.

Despite the above, the teacher's approach to discussions remained teacher-centred: 'Sim, now who's being the teacher?' and both her own and local community values were evident (no nude Akuba dolls or mention of fertility rites please!). She still had to learn how to give her students access to tools and experiences that enable students to expand their intelligence and synthesise concepts and ideas about the society in which they live. This requires the notion that the visual arts, as activities of the mind, involve problem seeking and solving.

Teachers do not need to have studied art history, which is mostly subjective, or to know the philosophical background to aesthetics, to achieve the above. Selection of artworks and issues that stimulate their students, providing foundational information, and scaffolding discussions is a good start. Students can be assisted to express the ideas and meanings communicated by artworks. They have the ability to discuss art in terms of the technical, sensory, expressive and formal properties of the work within a social and historical context. By using inquiry into these contexts as the framework for developing understanding, the arts perform a vital role in the intellectual growth of students, and the nature of the learning experiences will be diverse in character.

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Peekay

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Developing a thinking curriculum for Year 5: theory and practice

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Abstract

In this chapter Jason Pietzner discusses the theories behind his work with the thinking curriculum in his former Year 5 classroom. He examines Bloom's Taxonomy and Anderson's revision of this model and then shows how he has distilled them into the Three Storey Intellect model (Gathering/Processing/Applying). He then demonstrates the usefulness of Gardner's Multiple Intelligences theory and acknowledges the influence of Lipman's Philosophy for Children model. The product of his unit of work showing the effectiveness of the approach is included.

Introduction

Living in a world where information and knowledge are not static concepts, the students of today need exposure to more than the traditional curriculum. There needs to be new pedagogies to guide their learning. The citizens of the future need skills that will help them adapt to, and even exploit, new ways of being. A core idea associated with the term 'thinking curriculum' is that students should not be receptacles of other peoples' (particularly teachers') beliefs and knowledge. To ensure that we have engaged students, the constructivist approach, where students construct their own understanding of the world through the rigorous and analytical gathering and processing of information, is the surest way of achieving critical reflection and a more involved citizenry.

The thinking curriculum is, however, more than just a way of encouraging autonomy and reflection. It recognises that people use a variety of intelligences in order to know the world. The typical thinking curriculum practitioner would believe that you can teach a person to become a more effective thinker and use

the innate cognitive resources they possess to better effect. To this they would add that you can teach creativity, problem solving strategies and a philosophical approach to ideas, to help achieve depth in inquiry.

The belief that the curriculum must put students in touch with the world outside the classroom in a meaningful way is as important as the development of cognitive skills. The walls of a classroom must be removed to enable an engagement with issues that are present in the world of ideas and opportunities outside.

Behaviourism versus constructivism: the primary school

One could almost say that the difference between ‘traditional’ teaching styles and ‘thinking’ teaching styles is equal to the distinction between Behaviourism and Constructivism. The differences can be simply illustrated through the two scenarios below.

Scenario One

Students sit at single desks set in rows. The topic is ‘Asia’. This the students know because the heading is on the blackboard, along with copious amounts of writing that includes the countries found in Asia, their political systems, populations, primary products and so on. Students copy this information into their books, perhaps in silence. Following this, they colour in a photocopied map of Asia, marking out the different countries, under close instruction and observation by the teacher. The final session has the students making flags of the Asian country chosen by the teacher. Assessment is a written test, in which they diligently recall and repeat the information given to each by their teacher. A grade is given to each student following a test marked by the teacher.

In this classroom the students do not necessarily engage with the information, nor is there anything that they are required to interpret in order to show that they understand. The students’ opinions on the topic are not asked for, nor does the teacher tap into any prior knowledge the students may possess. The students have no control over their learning, nor are they taught the skills of questioning or research. The cognitive skill required by the students in order to successfully complete the unit (a high percentage score in the final test) is that of remembering information.

Scenario Two

Students enter a classroom where the tables are arranged in clusters allowing four students to work closely together. The teacher asks each group of students to discuss and write what they know about Indonesia. These discussions are then presented to the class in the form of a quick presentation using any pictures, mind maps, or notes the students made. Prior understandings are clarified, questioned and acknowledged by the teacher.

A newspaper article on the recent elections in Indonesia is circulated. A discussion of the article reveals that the students would like to philosophically examine the question of democracy as a political system. The teacher talks the least of all, using Socratic questioning methods to challenge the students and facilitate their conversation. The teacher then asks each group to develop a question concerning Indonesia that would require research in order to be answered. He or she works with each group to ensure that the questions are open ended and require significant work to develop adequate answers.

Perhaps the most significant difference between the two teaching styles is that the amount of information disseminated by the teacher in Scenario Two is close to none at all. While the teacher may have corrected some misconceptions during the initial discussions, and chosen the newspaper article to provoke conversation, at no point were the students directed to uncritically absorb the knowledge held by the teacher.

The critical difference between the two sessions is that the students were obliged to construct their own understanding of a part of Asia in the second, while they were required to remember their teacher's understanding in the first. In Scenario Two students are actively and constantly involved in creating their own knowledge about Indonesia, and while this is happening, they are learning a range of other skills that will enable this process to continue. The students are learning how to learn and they are learning how to think. The teacher is teaching the students skills, not facts.

While the Constructivist model should form the basis of all thinking curriculum units, every unit should contain other pedagogic models. Theorists like Bloom (in Pohl, 2000), Gardner (1989), de Bono (1996), Lipman, Sharp and Oscanyan (1980), and Herrmann (1996) provide strategies, models and ways of understanding learning styles.

Taxonomies

Bloom and colleagues first developed the Taxonomies of Cognitive and Affective Objectives in the 1950s as a means of labelling the different types of thinking that can occur as well as ranking them qualitatively. Through his model Bloom was stating expressly that, though all types of thinking are important, some types of thinking are harder to achieve than others. In the cognitive taxonomy, skills were placed in order from the simplest to harder cognitive tasks. The taxonomy was later revised by Anderson and a team of cognitive psychologists (Pohl, 2000). The taxonomy, along with its revision, is summarised in Chapter 1. One or other of these taxonomies is now frequently used by teachers attempting to develop their students' higher-level thinking skills, the skills most valued by the thinking curriculum practitioner. The student who can analyse information and apply it in new situations will better

adapt to a new and changing world, as will those students adept in making reasoned judgments and creating ideas.

For the purposes of the unit discussed in this chapter, Anderson's cognitive categories (in Pohl, 2000) have been incorporated into a model that recognises the importance of all the categories, but combines them into the Three Storey Intellect's categories: Gathering, Processing and Applying.

The model below exemplifies the importance of each level of thinking and makes clear the hierarchy of skills. It also stresses the importance of one skill being necessarily built upon by the next higher skill.

The range of skills is comprehensive and the depth and difficulty of the skills required at each level increases gradually. This allows students to develop their knowledge and cognitive skills at a steadily increasing rate. The content of a thinking curriculum unit would be skewed towards the more difficult categories.

The Three Storey Intellect	Anderson's Categories
<i>1 Gathering</i>	
Requires you to find the facts, to acquire knowledge and understand the material.	Understanding Remembering
<i>2 Processing</i>	
Requires you to manipulate information, to try to make connections to prior knowledge and previous experience and make sense of things.	Applying Analysing Understanding
<i>3 Applying</i>	
Requires you to use ideas you have gained to solve problems or make decisions. Apply your knowledge and understanding to new situations in meaningful ways.	Creating Evaluating Applying Analysing

Gardner's Multiple Intelligences

Gardner's theory of Multiple Intelligences first appeared in the early 1980s. His studies of the development and breakdown of cognitive capacities, in opposition to Piaget's theory of development, revealed that the human mind could be viewed as modular in design. The theory was based on the belief that different areas of the brain, and different psychological processes, are involved in dealing with the different types of symbolic systems we use in understanding the world (Gardner & Hatch 1989). He believed that all people had particular strengths in some ways of knowing the world, and that these strengths may not be consistent across all types of symbol understanding. Simply stated, one may be excellent at mathematical understanding of the world while having little ability in knowing

how to decode (or encode) the world using the language of words. (The eight intelligences are described in Chapter 1.)

The value of this to the teacher is in the acknowledgment that there is a variety of ways in which one can know the world, and that all of these ways are equally valid and important. The traditional classroom (and no doubt many modern classrooms) relied primarily on the linguistic and logical mathematical intelligences when disseminating and assessing knowledge. The new model insists that teachers recognise the importance of allowing students to express their knowledge and understanding of the world (as well as the provision of learning experiences) in diverse ways. The model also assists in the development in children of a range of abilities allowing them to rely on those in which they are naturally stronger.

Philosophical inquiry

Socrates taught his students by asking them questions, demanding clarification of each answer and challenging his students with further questions. This cycle of question and answer developed in his students the intellectual rigour of a philosopher.

The ability to think critically and logically, reflect on understandings and beliefs, solve problems creatively and (perhaps most of all) ask questions, are skills that all students would value, and skills that all thinking curriculum practitioners should aim to develop (Wilks, 1995).

Rich Tasks and Productive Pedagogies

Education Queensland (2000) released a document that aimed to directly tackle many of the problems that were emerging with current educational practice. In its introduction it stated that:

The New Basics Project is about dealing with new student identities, new economies and workplaces, new technologies, diverse communities and complex cultures. Many approaches to education treat the current period of rapid change as a problem that will soon go away so we can soon get back to normal ... [contemporary society] should be the focus of debate, data analysis and collection, higher order thinking and basic skills building.

Useful in the creation of this unit were the sections on Productive Pedagogies and Rich Tasks.

Productive Pedagogies are classroom strategies that can be used by teachers when developing units of work or individual lessons. They all have the same purpose in mind, that is, to improve student outcomes through the development of higher order thinking skills, autonomy and connectedness to the world. The pedagogies are productive in that they focus teachers' efforts towards those

teaching strategies that have been shown to be most effective in generating the kinds of outcomes most valuable for students. These strategies include:

Higher order thinking	Deep understanding	Connectedness to the world
Problem based curriculum	Engagement	Student control

The appropriateness of these strategies to the thinking curriculum hardly needs stating. In the following unit the Productive Pedagogies are used as a checklist against which I compared my unit.

Rich Tasks are activities that are problematic, open-ended and (most importantly) have an authentic sense about them. This means students believe that the work that they are doing has a value that exists outside of the classroom itself. They are not simply completing a task because they have to for school. While all work that a student is set in a thinking curriculum unit should be rich in nature, it is especially important that the assessment activities at the end of each unit have a particular validity and importance inherent in them. Rich Tasks are pieces of work that should accurately reflect a real-life task in the world. They should be multi-disciplinary, genuine and useful.

The Significant Structures unit

In the Significant Structures Unit, a selection of the models outlined above has been used. Some theories have been used as checklists, some have been used as a model on which to base a single lesson, and others have been used as a framework to create the unit's 'big picture'. Together they create a rich and challenging unit in which students learn to think, do, say and discover.

The basis of this unit was taken from Education Victoria's *Curriculum and Standards Framework 11* (1995). It is called Significant Structures and uses The Three Storey Intellect and Gardner's Multiple Intelligences (1993) as its framework. The class was already well schooled in Lipman's community of inquiry model, an essential requirement for work of this nature. A grid below is formed from these two models and activities are developed in accordance with the two models' requirements. Students begin with activities at the Gathering stage and then move onto the Processing stage. For these two stages students must choose an existing structure to study in depth.

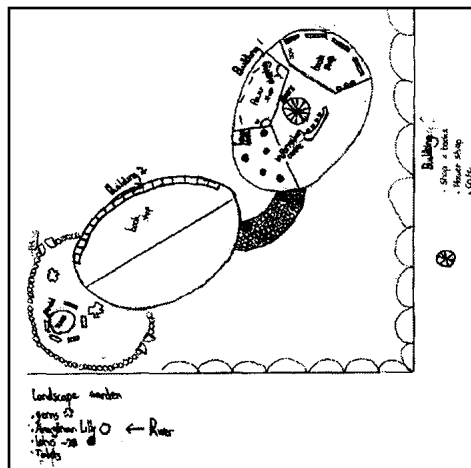
Significant Structures

A unit framed by the Three Storey Intellect and Multiple Intelligences

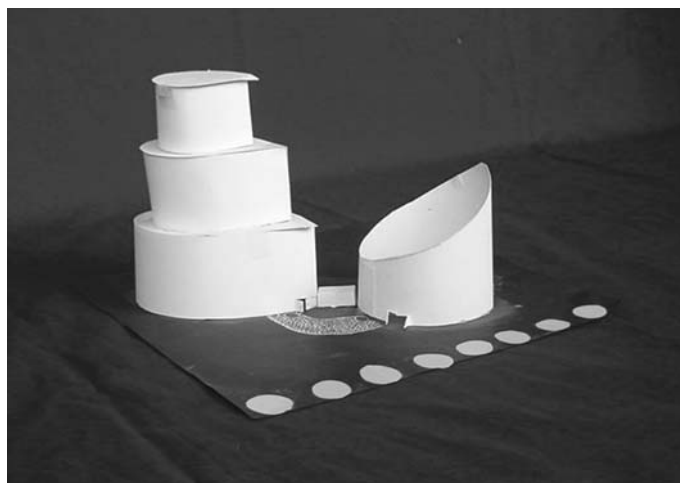
Develop, design and build a structure of significance for your community

	Verbal/ Linguistic	Logical/ Mathematical	Visual/ Spatial	Musical/ Rhythmic	Body/ Physical	People
Creating	Develop a written proposal.	Draw up architectural plans.	Sketch/paint some ideas for your structure.	Develop a musical composition celebrating your structure.	Build a scale model.	<i>Philosophy:</i> How can we help our community?
	Present your proposal and model to the local council.					Consider what our community would value most in a building.
Processing	Prepare and record an audio tour guide for your structure.	Reference significant parallels, meridians, equator, tropics, polar circles, prime meridian	Make a scale or ratio drawing of your structure using, set squares, rulers etc.	Make a Soundscape of the sounds that may be heard around your structure.	Interpret mood of building in dance.	Written response to the structure.
	Write a newspaper article for your structure.	and international dateline for your structure.	<i>Philosophy:</i> Why do we talk about both the 'form' and the 'function' of great buildings?	Write lyrics to a piece of music celebrating your structure.	Write and perform a play related to building.	Invite architect to talk about the building process.
	Develop a pamphlet advertising the structure.					Write to the Council justifying preservation of the structure.
Gathering	Read information on a significant structure of your choice.	Locate structure on a map—city/ world / country.	Draw a picture of proposed structure.	Find a piece of music related to building.	Re-create structure using Lego or K'nex.	Describe a building that is significant to you for personal reasons.
	Present a report to the class.	Find out dimensions.		Find national anthem of country.	Visit 'great' building if possible.	Interview a person involved with this structure.
	<i>Philosophy:</i> What makes a structure significant?	Timeline of events surrounding building. Identify patterns and shapes in structure.		Locate and share a piece of music from country.		

The unit finishes with a Rich Task in which students build a model of their significant structure. This is also the final evaluation piece, and students are assessed across all 'Intelligences'.



Sketch Plans



Scale Model

The productive pedagogies checklist

This following list of strategies and thinking skills was used as a checklist against which the unit was assessed for the presence of the New Basics' Productive Pedagogies (Education Queensland, 2000). Below are the Pedagogies along with examples of their use in the unit.

Strategy	Example of use
Higher order thinking	Anderson's/Bloom's Taxonomy
Deep knowledge	Study of one structure through a variety of activities
Substantive conversation	Use of philosophical inquiry at each level

Strategy	Example of use
Metalanguage	Students taught about structure of unit grid and aware of its purpose
Knowledge integration	Final task requires use of a range of intelligences to complete satisfactorily
Background knowledge	Students write about a structure significant to them
Connectedness to world	Talk by a visiting architect about real building processes
Problem based curriculum	Final Rich Task, though most tasks were problem based
Student control	All activities negotiated with students
Engagement	Students enjoyed all activities
Explicit criteria	Negotiated with students before each task
Inclusivity	All students participated equally
Narrative	Not in evidence
Citizenship	Final structure designed for benefit of community

This unit, then, can reasonably claim to use a comprehensive range of both productive pedagogies and thinking curriculum aims. Not only are students taught to think at a variety of levels, a skill they will require for the future, but they are also encouraged to be the kind of caring and community minded citizens that we need for this future.

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Crying Out
 Anthony Nguyen
 Year 7 St Bede's College



Boab Tree
 Sarah Higgins
 Grade 5 Stanley Primary School

Negotiating a thinking skills curriculum in Year 8

David Reynolds

Princes Hill Secondary College

Abstract

The need to develop a unit combining Year 8 Society and Environment and English classes provided Reynolds with an authentic purpose and the motivation to draw together approaches used to promote higher order thinking. Kate McArthur, a student teacher he was supervising, indicated an interest in the area, so the planning of this unit occurred as a collaborative process. Together they assessed theoretical principles, identified the needs of the students, established key conceptual goals for student learning, and wrote appropriate assessment criteria. Once the broad outline was in place, reflective learning and adaptation occurred as the unit progressed.

Introduction

The overall aim of the unit of work for Year 8 students was to develop deep thinking about an issue or problem, so the curriculum not only had to provide opportunities for building complex understanding, but also had to engage and sustain motivation and interest. The need for engagement of students is well documented as a key issue in middle years' teaching. Its absence indicates that a gap exists somewhere between learner, curriculum, teacher and learning environment. This meant that the unit had to be based upon a sound understanding of the means to connect these elements.

This unit draws on principles that underpin the design of numerous recent examples of middle years' pedagogy and are an adaptation of progressive and revisionist theories. This includes the rediscovered social and cultural imperatives of Vygotsky's learning theory and recent understandings revealed by brain research incorporated into Gardner's Multiple Intelligences theory.

It is also important to acknowledge the influence of John Dewey's view of the social and democratic context and purpose for schooling. Dewey's

concept of the person was that each individual possessed intrinsic value, and institutions such as schools should exist as a means subordinated to this end. Dewey's educational method was based on the notion that thinking is problem solving and that when designing curriculum the individual's purpose for the learning should be the starting point. His conception of the learning process was one of beginning with the whole and then proceeding to the component parts. He asserted that learning occurs most effectively when learners are engaged in a process of solving problems that are practical in the sense of having real capacity to improve society. From this it follows that students need to be involved with learning that is not divided from the world outside the classroom.

In grounding the following curriculum plan on the progressive approach of Dewey we intended to maintain rigour. We wanted to provide students with explicit and structured learning in critical thinking skills and to measure this attainment in an objective and consistent way.

Students need to engage in a curriculum that results in thinking of high intellectual quality and which pursues a genuine purpose. We sought to move away from a traditional textbook approach that provided students with a predictable pattern of work and often disconnected and superficial thinking activities. Newmann and Wehlage (1996) described worthwhile and significant achievement to be *authentic intellectual work* only when based on three criteria:

- first, the construction of knowledge—the development of knowledge through verbal, written or other demonstrations of cognitive work,
- second, disciplined inquiry—building upon existing knowledge in a given field and elaborated communication that embody this knowledge, and
- third, value beyond school—the achievement must have personal, aesthetic or utilitarian value beyond school.

The unit we designed satisfied each of Newmann's categories.

We accepted the thesis that knowledge interconnects (particularly when it is acquired at a deep level) in an interdisciplinary manner and planned to cover the conceptual and disciplinary areas of Society and the Environment and English. However, we were concerned that one of the key motivating elements of the unit should be its basis in the prior knowledge and concerns of the students. Beane argued that what engaged young people was the need to answer powerful questions:

When the curriculum of the school engages young people in seeking answers to powerful questions about themselves and their world, and when knowledge and skill are used for this purpose, the learning that takes place is an authentic human activity

requiring no tricks, gimmicks, or tests for 'motivation'. But more than this, they find that such activity inevitably and naturally raises possibilities for genuine valuing, cooperating, thinking and acting.
(Beane, in Stevenson & Carr, 1993, p. viii).

It was for this reason that the starting point for this unit was the students themselves. We took great heart from the attempts of teachers such as Mike Muir (1998) who applied the approach developed by Brodhagen, Weilbacher and Beane (1992). Muir dedicated substantial class time to establishing curriculum content that was based genuinely upon what was relevant to the students. Furthermore he followed Beane's tenets and provided them with opportunities for varied, extensive and in-depth work.

Beane's tenets for curriculum content

Beane's tenets for curriculum content are:

- explicitly involve questions and concerns from the young people who will actually carry out the unit,
- involve questions and concerns that are widely shared among young adolescents,
- involve widely shared, larger world concerns that are of clear and compelling social significance,
- engage a wide range of knowledge, skills and resources,
- pose opportunities for in-depth and extended work,
- present possibilities for a wide variety of activities, and
- present possibilities for personal and social action, both in school and outside the school.

The need to sustain student motivation and an innate drive to engage in deep thinking required us to adopt a model that maintained students at the centre of the learning. It would have been disingenuous of us to allow them to choose content and then reclaim the curriculum back from them. In leaving the students in control of the curriculum they needed to be presented with a persuasive reason why they should persist with the hard work of acquiring knowledge about the issue. The work of Barrows (1985) and Stepien and Gallagher (1993) in the area of problem-based learning provided a framework to drive student learning.

In *problem based* learning students are presented with real world problems based upon issues in which they have a personal stake. They have to develop problem-solving skills and deep knowledge of the complexity of the content in order to arrive at an acceptable solution. Several characteristics of problem based learning seemed applicable for this unit. These included its reliance on problems to drive the curriculum. Characteristically the problems are ill-structured with multiple solutions. Students engage in a reiterative process of gathering new information, evaluating it, forming hypotheses and reforming their perception of the problem. The aim is for students to solve the problems while the teachers are coaches and facilitators who model the thinking students need to employ. Authentic, performance-based assessment is a seamless part and end of the instruction.

According to Hildebrand, Mulcahy and Wilks (2001) there are three definable stages in problem-based learning:

- encountering and defining the problem
- accessing, evaluating and utilising information, and
- synthesis and performance.

It was decided that student assessment in this unit would occur through the periodic recording of a Learning Journal in which students could reflect on the progress they made, both individually and collaboratively, as the class moved towards a solution. A final display to an audience of people who had a significant stake in the solution would provide an opportunity for criterion-based assessment of discrete skills and learning outcomes.

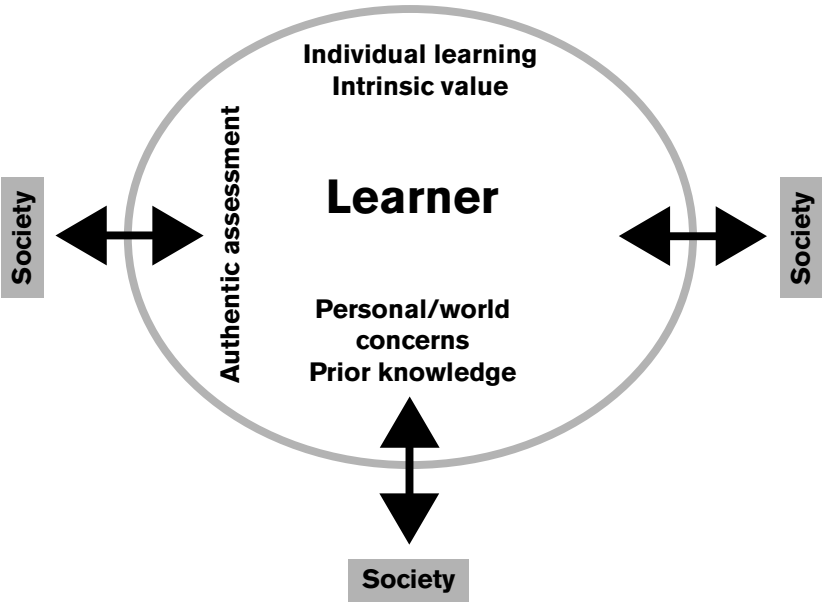
Finally, in the development of this unit, it was important to address the learning needs of individuals in the class. Vygotsky theory tells us that learning occurs as a result of social and cultural interaction around the mastery of a range of cognitive tools—tools of a cognitive, linguistic physical and electronic nature. We were aware that the pedagogical approach taken as students were guided through the problem-solving stages should engage them in learning within their zone of proximal development (Vygotsky, 1962).

As well as problem-solving skills, data gathering and critical thinking skills needed to be modelled and then scaffolded with individuals. Consideration would also be given to Gardner's theory (Gardner & Hatch 1989) that individuals possess different intelligences and therefore a predisposition to learn in one or more of these areas.

In summary, the educational philosophy underpinning this unit was a view of the learner and school representing a microcosm of society, where learning is a process of engaging with the real world, mastering its tools and deepening one's knowledge about its intrinsically problematic nature.

The Learning Model below represents the theoretical background to the unit. Following this is a Society and Environment/English unit with a problem scenario and reference to learning activities. There are also tables that contain student concerns about themselves and the world. Finally, there is information about assessment requirements and criteria for the unit.

The Learning Model



The unit

An outline of the combined Studies of Society and Environment and English unit containing learning activities follows.

Lesson	Activities
1–3	<i>Negotiating the curriculum</i> • Teacher explains aims and procedure. • In groups of four, students construct lists of questions about personal and world concerns (see later this chapter). • Students compare and consolidate their lists with other members of the group. Group lists are constructed. • Group lists are displayed. The class discusses relative weight of questions and attempts to consolidate further. • Three to four 'Big questions' are chosen, written on sheets of paper and stuck around the room. On each piece of paper, students write activities they would like to undertake to find answers to each question. <i>Reflective thinking</i> • The purpose of the Learning Journal (LJ) is explained. Regular entries are to be written and a longer coherent piece synthesising ideas is presented for assessment at the end of the unit.

	Students think about individual and group thinking that occurred during the group activities. Each student completes a Plus–Minus–Interesting (PMI) in their Learning Journal (LJ). Group roles are established and written in the LJ.
4	<i>Encountering and identifying the problem</i> - Students watch the video <i>The A–Z of Risk: a young person’s guide</i>. - Students write LJ entry in response to a series of prompts. - Students take it in turns to read out LJ entries—discussion. - Students write down a list of the things they expect from programs such as the video. A set of criteria for evaluating drug education programs is drafted. - Jigsaw activity. In groups of four students read and discuss a short text describing a drug education program. They then divide and move to another group where they are the ‘expert’ on their original text. Students take it in turns to summarise their text and then the group evaluates each one by referring to the class criteria.
5	- Present students with the Problem Scenario (see later this chapter) and timeline for completion of presentations. - Students choose their own groups (between three to five) to work on the ‘solution’. Students draw up a table in their LJs with <i>What we know</i>, <i>What we need to know</i> and <i>What we need to do</i> as three headings for reflective thinking. - Class lists drawn up on the board under these headings. An Action Plan for working through each of the two parts to the problem is devised in each group and then written on the board.
6	<i>Action Plan</i> Gather information about drug education programs. Analyse and evaluate information. Synthesise ideas. Write article. Devise and rehearse lesson. Present lesson.
7–8	Students complete the MICA. Multiple Intelligences sheet distributed and explained. Activities relating to each of the MIs provided for students to cut up and paste onto a large sheet under the Action Plan headings.
9–14	<i>Accessing, evaluating and utilising the information</i> A range of information is provided to students about drug education programs. Students use the criteria established earlier to write an evaluations in their LJs. <i>Evaluation criteria</i> Title Author/publisher Intended audience What is the purpose of this program? Does it tell us anything new? If so, what? What is the underlying message? How realistic is it? What techniques does it use to persuade/inform you? What sort of assumptions do the producers make about young people?

15	Students watch the video titled <i>The Mountain</i> and complete their evaluation. In groups discuss the way that the message is presented through the use of a parable narrative structure and metaphor and how effective this genre is to convey values and advice. Students write their own parable based around a risk-taking activity.
16	- Students write a LJ entry with a Mind Map connecting the information they have been evaluating and key ideas. Teacher models Mind Map on board. - Students examine two short newspaper articles about former drug addict, Greg Chipp. Answer questions for homework.
17–20	<i>Synthesis and performance</i> - In groups students return to the problem and determine what they need to do to effectively communicate their evaluations of the programs. - Students examine a magazine article. Teacher models deconstruction of linguistic and semantic features with overhead projector. Students presented with a plan for writing their evaluation piece as a group. - Each student writes up a review piece on one or two of the examples of drug education programs examined in class. Groups then work on how to combine each piece into a coherent article. - Drafting occurs and group edits each member's work. - Final piece is written up on MS Publisher. Copies sent to <i>Stuff</i>, Australian Drug Foundation, College Drug Education committee, and Youth Advocacy Group.
21–25	- Lesson Planning begins. Each group has to deliver a 10 minute 'mini lesson' about drugs. Groups brainstorm activities—draw on MI list of activities used in earlier Action Plan and own criteria for effective drug education programs. LJ entry written about process and ideas. - Students prepare materials and rehearse lessons (fact sheets, surveys, scripts, game boards, props, costumes are all created by different groups). Write up a lesson plan detailing Timing, Activities and Resources.
26–27	<i>Presentation</i> - A large classroom is booked for the Year 8s to 'perform' their lessons for the Year 7s and to engage them in activities (numerous spectators view the proceedings). - Seven 'mini lessons' then happen with the Year 8 students orchestrating pretty much the whole thing. Teacher relegated to operating the video. - Final Learning Journal task given for completion over long weekend.

The problem scenario

Today, drugs are regarded by many as a huge problem facing young people. These days lots of money is spent by governments on advertisements about drugs and on drug education programs. Yet many young people say these programs are not realistic, are condescending and don't tell you anything new. With the federal election coming up the Prime Minister has started making promises about increasing the amount of funding for drug education programs (including advertisements). Your class, Year 8, has been asked by a youth advocacy group to evaluate these programs from the perspective of young people. This evaluation is to be written and then forwarded to a publication able to communicate your opinions in the most persuasive form.

The teacher of a Year 7 class at your school has heard about the work you are doing on drug education and has asked you to give her class a lesson. She has been planning

to provide drug education for some time and thinks her students will respond better to people close to their own age. The possibilities for drug education are endless. How will you and your group design a lesson for the Year 7s that teachers and parents will accept and, more importantly, that the Year 7s will feel meets their needs?

Concerns about Self–Year 8

<i>Career/education</i>	• Will I get a job when I leave school? • Will my job be exciting and/or enjoyable? • Will I have a good job that pays well? • Will I do something worthwhile when I am older? • Will I pass Year 8? • Will I pass VCE? • Will I finish high school? • Will I do well at university? • What can/should I do now to start/help my career in the future?
<i>Lifestyle</i>	• Will I keep skating and playing basketball? • Where will I live?
<i>Relationships</i>	
<i>Marriage</i>	• Will I get married? Will I have children?
<i>Parenting</i>	• How can I teach my children to be good and how am I going to protect them?
<i>Conflict</i>	• Will my dad ever let me watch <i>Clockwork Orange</i>?
<i>Peer group</i>	• Will my parents kick me out before I am 17? • Will I get involved with the wrong crowd? • What will happen to my friends and me when we leave school?
<i>Emotions</i>	• Will life be hard? • How will I cope with Years 11 and 12? • Will I be happy or depressed?
<i>Success</i>	• Will I be successful in all walks of life? • Will I become famous?
<i>Death</i>	• Will I die old or young? • How will I die?
<i>Drugs</i>	• Will I be a drug addict?
<i>Economics</i>	• How will my parents' business go? • Will I be rich or poor?
<i>Values/attitudes</i>	• Will the world's views and my views change much when I am older?

Concerns about World–Year 8

<i>Conflict</i>	• Who blew up the World Trade Centre? • Why are the Arabs so pissed off with the Americans? • Is America going to bomb the innocent like they did at Hiroshima after Japan bombed Pearl Harbor? • Will there be a third world war? • Will there be a nuclear war?
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<i>Refugees</i>	• What will happen to the refugees? • Will Australia keep on getting 'boat people'?
<i>Poverty</i>	• Will anything be done about global famine and poverty? • Will there ever be any large-scale campaign to fight poverty?
<i>Environment</i>	• Will the world be here in the future? • What will happen with global warming? • Will the forest situation be fixed with the help of humans? • Will the world end because of pollution?
<i>Politics</i>	• Will the situation in the Middle East be resolved? • How will the politics of Zimbabwe turn out? • Will the Kyoto Treaty be successful?
<i>Drugs</i>	• Should marijuana be legal?
<i>Technology</i>	• How far will technology advance? • Will we have hover-cars?
<i>Utopia</i>	• Will the world ever be perfect?
<i>Extraterrestrials</i>	• Is the human race alone in the Universe?

Assessment

Each student has to submit the following for assessment.

Learning Journal containing:

- The article evaluating drug education programs
- Lesson plan
- The lesson (recorded on video)
- 6 short progressive entries
- PMI/Mind Map/KND activities
- 1 x 2-page final evaluative entry

Assessment criteria for unit

<i>Knowledge</i>	• Evidence of knowledge of topic. • Demonstrated ability to analyse and synthesise information from a variety of sources.
<i>Skills</i>	• Used appropriate linguistic structures (introductions/conclusions, vocabulary, grammar, spelling and punctuation) according to purpose and audience. • Used a range of strategies to engage and inform audience in each presentation. • Evidence of thorough planning and rehearsal. • Evidence that student/s have reflected on work, considered suggestions and feedback from peers/teacher, and modified/improved lesson plan and article accordingly.
<i>Values</i>	• Demonstrated an awareness of the values inherent in drug education programs. • Developed a personal position on the moral responsibilities of drug educators. • Able to justify lesson segment in terms of this personal position on the moral responsibilities of drug educators.

(Possible gradings: Not Evident, Poor, Good, Very Good, Excellent)

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Designing a thinking curriculum for later middle years' adolescents

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Abstract

Bawden focuses on a range of learning and brain theories concerning how students learn and contexts for learning. He examines the implications of these theories for curriculum organisation and the development of appropriate pedagogies for adolescents in later middle years schooling, Years 7–9. A thinking curriculum, a multi-disciplinary approach to the issue of conflict and how this uses higher level thinking skills, a variety of learning approaches, and authentic assessment, are all described. Opportunities for students to reflect on their understandings are included.

Introduction

Teachers wishing to promote higher level thinking skills draw on the work of many learning theorists when designing classroom activities. Many have considered relatively contemporary brain function theorists, such as Atkin (1993) and Herrmann (1996), who use findings from neuroscience to assist teachers designing curricula and teaching practices. The first implication from the newer findings about brain function is the importance of organising learning experiences around 'real' experiences so the brain can make connections to previously assimilated material. Neuroscience appears to favour the constructivist and discovery learning theorists, rather than the behaviourists. Some claim the behaviourists do not consider there are any internal mental processes taking place, yet science has shown the brain is making physical connections. The implication that educators must build on previous learning is not new.

Hannafor (1995, in Jensen, 1998) claims that both the right and left hemispheres of the brain are fully developed between the ages of 11–13. The corpus

callosum is capable of carrying four billion messages a second across 200–300 nerves and is ready for increased challenges and higher thinking skills. The implication that educators can draw from neuroscience is that *young* students should be given thinking tasks that are engaging and challenging.

The needs of students in the middle years are now well documented. They enjoy cooperative learning and, providing it is not merely social chatter, this is essential for brain growth. The brain thrives on internal and external feedback (Harth, in Jensen 1998). Internal feedback means that the brain moves forward based on integrating new learning. External feedback comes in the form of peer-conferencing and reflective social behaviour, rather than a teacher. The influence of peers in these areas can assist a teacher in modifying adolescent behaviour and increasing motivation.

The constructivists suggest that we alter our mental models to accommodate new information and that the learner seeks to find new meaning in response to big picture questions. This is not to say that there is no attention to detail, only that in the process of attempting to answer the broader philosophical questions, individual students will search out the facts and apply them in ways that make meaning personal (Brooks & Brooks, 1993).

Thinking about the middle years

The implications of this for middle school curricula are profound. The recent developments in brain research and literature on the needs of adolescents (for example, Braggett, 1997; Hill & Russell, 1999) support the view that a safe, accepting classroom environment, free of negative critical behaviour on the part of the teacher and other students, is essential for good learning.

Middle school students require a close relationship with a smaller number of teachers, and it is important that they feel comfortable to take risks, explore, make mistakes, be accepted, be given a chance to grow and develop and to feel comfortable with a teacher. The teacher on the other hand needs to be able to work as a guide and mentor and model good behaviour, be an active learner to feel comfortable in making compromises with students, and be capable of effective class management.

The role of emotions in determining our state of mind must also be considered (Goleman, 1996). It is also important for teachers to ensure their focus is not too narrowly set on the development of thinking skills alone. We should also pay attention to developing the dispositions, attitudes, and habits that constitute the intellectual character of students.

However, curriculum offerings in many middle years' classrooms often do not extend students' higher level thinking skills. There has been criticism that the curriculum is often 'dumbed down'. Epstein (in Jensen, 1999) discovered that only 5 per cent of students at age 11, and 25 per cent of students at age 14, had developed formal reasoning skills. The percentage increased to only about 50 per cent of the population by the time they became adults. It appears that

teachers have not been spending enough time developing these skills. Clearly, what is needed are new pedagogues and practices that encourage higher levels of thinking. In fact, the whole classroom should permeated by an atmosphere of inquiry.

According to Tishman and Andrade (1995), a thinking classroom should offer:

- models of good thinking dispositions,
- explanations of the tactics,
- concepts and rationales of good thinking dispositions,
- peer interactions that involve thinking dispositions, and
- formal and informal feedback around thinking dispositions.

Less classroom time needs to be spent on the reproduction and gathering of facts and information and more on thinking and reflecting. Students need to be able to discuss their points of view and demonstrate that they can be engaged in meaningful inquiry, analysis, and modifying and evaluating of opinions and points of view. The questions they explore need to grow from their goals and interests.

All the above have implications for the time students and teachers spend on assessment tasks. The notion of continuous assessment, with the idea of authentic tasks based on clearly identified criteria and a ‘real’ situation, is an issue that some teachers find difficult.

Muir (2000) suggests that teachers planning tasks for middle years’ students need to address the following:

- Context
Why do we have to know this? This places content within the context of how it is (or might be) used in the real world. It could involve a simulation, doing real work, or having a real audience (beyond the teacher) for student work. It provides a goal for which learning the content is necessary.
- Curiosity
Teachers work either to build on student curiosity and interests or to capture their imagination by making content interesting. It includes using conundrums, contractions, or other strategies to stimulate student questions.

- **Control**
Students share decision-making and authority within the classroom. They may negotiate the curriculum with the teacher, or help the teacher decide how they will learn the curriculum. It means they have choices about their learning.
- **Community**
The classroom environment provides for positive relationships with adults and peers, and fosters a sense of belonging among its members, characterised by support, respect, and dignity.
- **Alignment with student goals**
Teachers connect content and classroom experiences and activities with students' personal goals.

Conflict: a big idea

The aim of a curriculum based on the issue of conflict is to both integrate knowledge and encourage students to be more than fact-gatherers or project-makers. It is important that students learn to work cooperatively on problem solving (individually and in groups) and are trained to think and reflect about their progress. The neuroscientists' findings, the constructivists' theories, and Gardner's (1993) ways of knowing can be synthesised into a learning program that encourages students to use higher thinking processes.

Using learning technologies

The use of learning technologies allows students to proceed at their own pace and use different mediums for presentations that encourage creativity. Sandholtz (1997, p. 48) states:

Technology is a catalyst for change in classroom processes because it provides a distinct departure, a change in context that suggests alternative ways of operating. It can drive a shift from a traditional instructional approach toward a more eclectic set of learning activities that include knowledge-building situations for students.

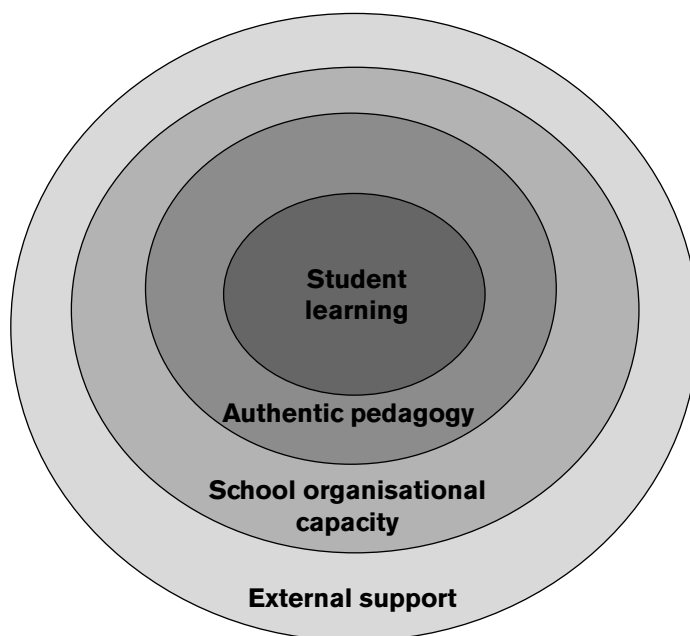
Information technology assists students to become empowered and spend more time in active construction of knowledge. Teachers already employ a variety of instructional strategies. They utilise computers, groups, field trips, guest speakers, pairings, games, student teaching, journals, and multi-age projects, to name a few. Jensen (1998) suggests students need to be given choice in the type of project they choose, and how complex it needs to be, as well as freedom to choose the format they want to use to present their findings.

The curriculum outline that follows is an attempt to synthesise these ideas into an integrated curriculum unit that enables students to pursue their own interests and use technology to motivate, enhance, gather and present information while covering aspects of the Key Learning Areas. It is an attempt to merge the current subject-based curriculum into a coherent whole that is meaningful for the student as suggested by Newmann and Wehlage (1996). Their ideas have been studied in the classroom and they claim the employment of these strategies has improved students' performance by 26 per cent in the US test scores. Similar results have been found in an investigation carried out in selected classrooms by Education Queensland (<http://education.qld.gov.au/corporate/newbasics/>).

Gardner and Pace (1997) described a utopian school called 'Kings', in which their ideal vision of a school operated according to the principles of integration of learning styles, student interest and constructivist philosophy. The reality today is that many schools are attempting to change their middle schools by aligning their structures with the ideas of integrated curriculum. This is often done with little student choice or input, and with few changes in terms of assessment and reporting.

Between 1990 and 1995, the University of Wisconsin–Madison (UW–M) researchers analysed data from more than 1500 elementary, middle, and high schools and conducted field studies in 44 schools in 16 states. They concluded that restructuring was not effective unless there was a thinking curriculum based on deep inquiry. Their research assumed that we start with the students and work outwards (Newmann & Wehlage, 2001). The figure below depicts the dimensions of support within the school that students require if deep inquiry is to occur.

Circles of Support—a context for successful school restructuring



An integrated unit

The aim of the following curriculum designed around the notion of conflict is to offer a compromise that uses the curriculum topics already required to be ‘taught’ at my current school. It incorporates the required Key Learning Areas into a student-focused integrated unit for Year 8 students. It focuses as much as possible on the UW–M concentric circle ideas in the figure above, with the student being most important. It also incorporates authentic pedagogy and assessment.

The online curriculum module offered by Harvard University (<http://learnweb.harvard.edu/alps/thinking/>) has been utilised to structure the ideas. The aims of the unit are that students will:

- understand relationships and connections between content areas,
- develop awareness of global issues and big ideas,
- practise problem-solving and critical thinking,
- create new knowledge and products of learning,
- acquire academic and research skills,
- explore their creativity, and
- increase their motivation to learn.

ALPS unit design of the online curriculum model throughlines

The questions I want my students to understand after this course or year are:

- What are the reasons for human conflict?
- Why is conflict necessary for dramatic and performing arts?
- Is conflict a necessary part of human existence?
- Is conflict always bad?

In addition, student generated questions will be encouraged.

Higher order thinking skills are being encouraged here. In addition, the constructivist approach (Bruner, 1973) of asking students what they already know and want to know about conflict, is employed. In an ideal situation, the entire curriculum could be based on the exploration of student-generated questions.

Generative topics

What will students learn about?

The story of Anne Frank and how she coped with individual, family and social conflict during the Second World War is still an inspiration to students today. The students can study the text, play or movie with an emphasis on self-reflective comprehension questions at home. Classroom discussions will involve an analysis of her family's coping skills and the implications about Anne that can be gleaned from the text. Students will be encouraged to examine the political and social background. The purpose is to start with the student and work outwards towards an understanding of the broader issues according to the Newmann and Wehlage's (1996) model. The unit examines world conflict, intrapersonal and interpersonal conflicts, and religious and racial differences. Students will:

- understand the necessity of conflict in the creation of effective literature and music.

Rationale: not all conflict is bad. In the arts, conflict is necessary for the creation of dramatic tension and students are encouraged to identify the tension between musical elements and story writing elements.

- examine the effects of conflict on individuals and society through class discussions and formal debates.

Rationale: debates offer students the opportunity to discuss their thinking and reflect while thinking and listening to the arguments put forward by their peers.

- through Society and the Environment (SOSE) research the causes of a world conflict from a historical and contemporary perspective.

Rationale: student choice. The multi-cultural nature of Australian society has, in many cases been a result of escape from conflict. The unit provides students with an opportunity to analyse the reasons for the conflict in the lives of themselves and their families. The web quest *The Costs of War* (see Bibliography) is the basis for this unit.

Why is this worth learning?

The choice of 'big picture' issues that by their very nature have no obvious solution, promotes the development of critical thinking skills. This development is aided by engaging them in the three levels of thinking skills as suggested by Haynes and Haynes (2000): reflective and inquiry skills, analysis of concepts, and meaning making.

Goals for understanding

What will students come to understand during this unit?

- The reasons for conflict can include, power, intolerance, religion, economic dislocation.
- Students should develop an awareness and sensitivity to the plight of countries affected by war, poverty and indifference.
- Anne's growth and the interpersonal relationships between the members of the community in hiding cause emotional conflict. Students will be encouraged to reflect on the nature of these relationships and reflect on their own family dynamics.
- The concept of speaking out against intolerance, prejudice and the oppression of minorities is not just for others. Students perform an oral presentation and write a Letter to the Editor about an issue that is causing conflict.
- Students will appreciate the importance of conflict in creating effective literature, film and music.

Performances of understanding

What do you want your students to do to build and demonstrate their understanding?

(The outcomes are described according to traditional subject divisions.)

English

- Students will role-play situations and answer questions after close study of the text that encourages reflection on the life of Anne Frank, and imagine themselves in similar situations.

Rationale: This is not merely a comprehension exercise testing facts and knowledge of the text for its own sake. It represents an attempt to engage students in placing themselves in the situation of being confined, threatened and bored and having to deal with the personal differences between people of different genders, life experiences and cultural background.

- The role-play will be one where the students experience what it is like to be a refugee fleeing their home and they will reflect on this through journal writing.

Rationale: Through simulated role-play students imagine themselves in the following situations at various 'stations' around the school.

Role play

- Students bring 20 objects they need to live on a deserted island. At school, they are told they are being moved because of an outbreak of war.
- They move to point two and board imaginary trucks. During the journey, they lose bags and three students donate to the fourth student who has lost his bag.
- They proceed to the ship. The captain has to be bribed with the most expensive item.
- The rough trip ruins all non-waterproof materials.
- They are attacked by pirates and lose all valuables.
- Upon arrival, they must sell the remaining goods for food.
- How do you feel? Has your view of refugees changed? How? Why?

Music

Students will create a puppet play for younger students with a script that includes conflict and resolution, and an original song that reflects the feelings of one of the main characters. They will be given a chance to express the emotional, aesthetic side of their personality, explore creativity with set design, choose appropriate music to set the mood and design their puppets.

Students, especially boys, are able to sing and be expressive through the medium of the character. This reduces embarrassment and negativity. Conflict is often a necessary part of effective literature, drama and music.

Health and physical education

Personal and family conflicts

The Centre for Adolescent Health has an innovative program that attempts to address the emotional needs of Year 8 students. The program involves students in role-plays and explores issues of identity, self-concept, dealing with peer pressure and relationships with peers and family. It examines patterns of thinking and ways of dealing with personal issues and has a number of exercises that students complete.

Ongoing assessment

How will you and your students know what they understand?

Using the software program Inspiration, students keep a record of the connections they make between the areas of study. It can be a valuable form of ongoing

assessment and students can use the text boxes to record their opinions and observations.

At the beginning of the unit:

- Students will complete a brainstorm exercise on war. They should be encouraged to ask how, what, when, where, and why questions in pairs. They would then work in a group of four and refine the questions further.

Rationale: Students need to connect with previously known information.

- Students will be asked to examine the cover of the play of the *Diary of Anne Frank*. The cover contains images of war and Nazism and students will be asked to indicate questions they have and to identify anything they already know.

A discussion in class, together with journal reflections and questions, may provide stimulus for students in deciding on their area of research.

Assessment during the unit:

- Students will complete web quest activities of their choice and will be assessed according to clearly defined criteria. The websites at <http://rubistar.4teachers.org> contain excellent sites for generating criteria rubrics to make assessment criteria explicit. All activities can be prepared with rubrics.

http://rubistar.4teachers.org/view_rubric.php3?id=52519 contains a rubric for a class debate on a student generated debate topic.

- Oral presentation: Using visual props students present an oral presentation on an issue that concerns young people. They write a Letter to the Editor that demonstrates a reasoned opinion backed up by evidence to support the claims made in the letter.

Students should be encouraged to keep a record of their progress using the theme of conflict and the connections they have made.

How do new technologies enhance teaching for understanding?

The web quests are used to encourage progress at an individual pace as well as give considerable student choice and encourage higher order thinking skills. The Taylor site (see Bibliography) contains activities that are interdisciplinary.

In each of the main areas there are opportunities for students to use learning technologies to gather, analyse and present information in authentic ways. These include PowerPoint, Microsoft Publisher selected Web quests, Images, Graphics and Inspiration.

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Untitled

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Valuing and assessing higher order thinking skills in mathematics

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Abstract

The continuing perception of the mathematics classroom tends to be narrow. It is perceived as a subject where there is one correct answer and, at its worst, rigid and monotonous. Yet the reality of what is happening in mathematics classrooms need not be limited to such closed work practices. In this chapter Hoskins describes a number of stimulating activities that improved her students' thinking. They undertook practical explorations of trigonometric relationships, played fraction and decimal games with chocolates, explored the mathematics in cake recipes, and played games of chance to explore the fundamentals of probability. Herrmann's four modes of processing information and Ely and Caygill's categories for assessment caused Hoskins to consider her students' thinking styles. She also reconsidered assessment tasks to reflect these new classroom approaches and understandings.

Introduction

When I first began teaching twelve years ago, my students learned to add and subtract positive and negative numbers by ballroom dancing while counting floorboards. Last year, in a Year 11 class, I dressed up in a tutu and demonstrated to my students the magic inherent in calculus. Hardly rigid or monotonous!

For many years, teachers of mathematics have recognised the importance of varying the learning experiences of students. Mathematics teachers have adopted teaching techniques that provide authentic contexts in which students can apply problem-solving skills rather than simply practise algorithms and apply formulae. They have learned the importance of asking open-ended questions and giving students time to reflect on processes and appropriate answers.

There is no escaping the necessity of teaching algorithms, skills and formulae, but mathematics teachers have become very creative in their delivery of information and skills. Many teachers have acknowledged the importance of developing higher order thinking skills, and are developing classroom activities that assist students to attain these skills: they are attempting to design a thinking curriculum. I believe the problem now lies in how teachers recognise, value and assess these problem solving, reflective, higher order thinking skills.

Much of the discussion by educationalists at present is on cognitive processes, preferred learning styles and how to ensure students are given opportunities to develop higher order thinking skills. As a result, theorists' tools and classroom learning activities are being evaluated for their ability to provide students with the opportunity to develop higher order thinking.

Activities and resources

Many activities that stimulate complex and higher order thinking exist. An exciting resource called the Maths 300 activity pack (<http://curriculum.edu.au/maths300/>) provides teachers with ways of including analysis, synthesis and evaluation in their learning activities.

In 2001, my Year 7 students undertook a unit of work on probability that required them to explore game strategies, to hypothesise and to evaluate strategies of their own creation. The Sliding Ladder trigonometry activity from the MCTP Activity Bank (Lovett & Clarke, 1988) was completed in my Year 9 classroom. It encouraged students to explore the relationship between side lengths and angles in right-angled triangles, and to synthesise their understanding of the experiment to produce a statement about the relationship of their measurements and sine and cosine.

Philosophical inquiry (Lipman, Sharp and Oscanyan, 1980), if undertaken in the mathematics classrooms, also offers strategies that encourage students to analyse and evaluate fundamentals such as the purpose of using zero, or the appropriateness of the binary number system.

Herrmann's whole brain model

Teachers and schools are also exploring and adopting Herrmann's four-quadrant model of brain processing (in Atkin, 1993). Herrmann has identified four main modes for processing information. The model demonstrates the four modes and examples of relevant skills and activities.

Herrmann's whole brain model

A. Logical, Analytical, Quantitative, Fact-based.

Working solo
Applying formulae
Accomplishing
Analysing data
Putting things together
Making things work
Solving tough problems
Making the numbers
Being challenged
Analysing and diagnosing
Explaining things
Clarifying issues
Logical processing

D. Holistic, Intuitive, Synthesising, Integrating.

Taking risks
Inventing solutions
Providing vision
Having variety
Bringing about change
Opportunity to experiment
Selling ideas
Developing new things
Designing
Having a lot of space
Playing around
Seeing the end from the beginning
Excitement

B. Planned, Organised, Detailed, Sequential.

Building things
Being in control
Having an ordered environment
Preserving the status quo
Paperwork tasks
Establishing order
Planning things out
Stabilising
Getting things done on time
Attending to detail
Structured tasks
Providing support
Administering

C. Emotional, Interpersonal, Feeling-based, Kinaesthetic.

Getting groups to work together
Expressing ideas
Building relationships
Teaching/Training
Listening and talking
Working with people
Persuading people
Being part of a team
Communication aspects
Helping people
Expressive writing
Coaching
Counselling

Herrmann's four modes for processing information

Herrmann's model recognises different ways of knowing and responding to the world (Atkin, 1993, p. 13). He contends that, although we each have the capacity to function in all four modes of processing, individuals have preferred thinking styles. The value of his work is that it identifies and gives value to a range of different thinking styles in much the same way as Gardner's Multiple Intelligences. However, Herrmann's work is, in some ways, simpler to interpret and, because it does not limit individuals to specific thinking styles, it is easier to adapt and use in the classroom. The important point for educators is that, like the problem of incorporating higher order thinking skills in our classroom, this

range of legitimate, valuable thinking processes is rarely recognised or evaluated in our classrooms.

Rethinking assessment

Although mathematics classrooms incorporate a diverse range of learning activities, the majority of these activities do not assess the students' capacity to undertake higher order thinking. Most of the assessment activities in our classrooms tend to engage the students in only low level thinking tasks, that is, absorbing, translating and applying information. Few activities require students to demonstrate their ability to analyse, synthesise or evaluate. Furthermore, the activities undertaken to improve students' higher level thinking skills are often selected in a random manner. There is little coordination regarding development over time, or in ensuring that students recognise the value or purpose of such activities. Although the intentions are well conceived, there is little design in the development of the thinking curriculum.

What do the reporting processes record as important in the study of mathematics? The words that usually appear in mathematics report forms are 'works logically', 'applies the formulae', 'analyses data', 'follows procedures', 'attends to detail', and 'plans'. These habits are all closely tied to the preferred style of processing of Herrmann's Quadrants A and B (see p.111). Rarely do we see phrases such as 'takes risks', 'invents solutions', 'demonstrates vision', 'develops new items', 'plays around with ideas', 'experiments', or 'expresses original ideas'. These are the habits of those people whose preferred way of processing information lies in Quadrants C and D. Yet, the importance of these thinking styles is enormous for those people who pursue mathematics as a career, or participate in the study of mathematics at high levels.

Mathematician James Murray believes that mathematics can be imaginative and that what determines people who are good at mathematics is whether they can see things in a totally different way (in Devlin, 1998, p. 14). The ability to see things in a new way, a skill highly valued in this information age according to de Bono (1996), is a characteristic of Hermann's D quadrant thinking mode. Yet, it is this style of thinking that is least valued in the assessment and reporting processes of mathematics education.

I would describe the following two mathematics sessions as highly successful. The first involved an investigation of quadratic functions by my Year 9 class using the Graphmatica computer program. I showed the students how to graph $y = x^2$, how to adjust their grid range and to zoom in and out. As I was explaining how to identify points on the graph and the features of the parabola, the students were already exploring variations on $y = x^2$ and calling out their discoveries: 'When I put in $y = 2x^2$ it is much narrower!' 'When I do $y = \frac{1}{2}x^2$ it is wider.' 'When I try $y = (x - 1)^2$ it moves the parabola sideways!' It was so exciting to be in this classroom where the students were making the discoveries unprompted, and on their own. I abandoned the original task for the rest of the

lesson (which had been completing an exercise from the textbook) and we tried to devise rules regarding the shapes of parabolas. The class was able to come up with very effective directives for determining a parabola's shape.

The second successful session was with my Year 7 class. We began playing Multo, a form of Bingo where the teacher uses cards with multiplication equations on them as the calling cards. The students devise their own playing card to maximise their chances of winning. The activity requires knowledge of the multiplication tables, common multiples and probability. The excitement generated by the game, and the intensity with which the students manipulated their knowledge to maximise their chances of winning was impressive. In addition, one of the most interesting outcomes was that the student who most frequently experienced success with her Multo card was a student who performs poorly on tests.

Through these lessons I felt that I was achieving my aim to have students experience and develop connections, to think creatively and laterally, to experience a range of mathematics related activities, and to have fun with mathematics. But where does this show up in their assessment? Where can I report that Merv explores ideas in a creative way, Bilu makes thoughtful and clever connections, that Bec took great pleasure in pursuing an investigation and Ung Lee has the ability to synthesise information although she struggles to apply formulae?

When designing a thinking curriculum, we need to show that we value all thinking skills. We need to accept that there are a number of ways of processing information and acknowledging their value. If we don't incorporate a range of thinking skills into our reporting procedures, then the only learning that will be important for the students will be the superficial learning required to recall information, apply formulae and to follow procedures. Our current assessment procedures appear to demonstrate that students' interpretations are not relevant.

In their examination of different assessment formats Eley and Caygill (2001) contend that the use of richer assessment formats facilitates the development and learning of deep learning skills. How do we adjust our assessment practices so that they may effectively evaluate these skills? Eley and Caygill (2001, p. 22) adapted Bloom's Taxonomy of Cognitive Processes as a means of defining thinking skills appropriate to Mathematics and Science assessment.

Eley and Caygill's categories are:

- 1 Recall knowledge
- 2 Calculate/Follow formulae
- 3 Experiment/Investigate
- 4 Compare/Contrast
- 5 Conclude/Explain/Justify

For the first and second categories, traditional assessment methods of multiple choice and short answer/completion of algorithms would suffice. For category 3, mathematics teachers could adopt scientific reporting practices to enable assessment of these skills. Within the testing structure, development of questions would enable some evaluation of categories 4 and 5. However, the testing structure does not allow for the kind of reporting that I would have liked to make after the sessions described above. It is limited in its ability to assess synthesis and evaluation, or comparisons, contrasts, conclusions and justifications. Considering that it is, nevertheless, essential for students to master algorithms, calculations and the application of formulae, there is little room in the mathematics test to accommodate thoughtful, reflective, written answers. What alternatives are there for assessing these last two, higher order thinking categories?

We can't write notes on each student's contribution to class or group discussion after each lesson, although it is certainly possible to make the occasional note regarding a student's performance in class. However, some students are naturally quieter and less willing to expose their ideas before the class, therefore, relying on a student's participation in a class discussion would be inconclusive. It would be ideal to be able to conduct one-to-one interviews on each activity with each student. Eley and Caygill (2001) found this to be the most effective method of assessing students' abilities in these categories. Unfortunately, considering the amount of time this would take for the average class, time constraints render this method impractical.

Mathematics thinking journal

I believe a new method of assessment for the mathematics classroom is required. It should be one that enables students to reflect on their experiences, learning and ideas, so they can reorganise their knowledge and represent it in their own words. Consequently, I contend that having each student write entries into a mathematics thinking journal would be of value in assessing the thinking skills developed by him or her in the Mathematics classroom. It would provide opportunities for the recording of students' ideas, reflections, hypotheses, responses, and connections. It can be an opportunity for students to learn about their own thinking as well as provide access to students' misconceptions and thinking styles.

However, the introduction of a thinking journal into the mathematics curriculum requires careful consideration regarding its introduction and use. What exactly is expected of the journal? What tasks would the students be asked to complete in their journal? By what criteria would it be assessed? The intentions behind the introduction of a thinking curriculum must inform the use of the thinking journal.

When teachers are designing the mathematics syllabus they need to pay attention to the development and assessment of thinking skills. For each year

level, the areas of study to be completed usually remain unchanged but the teacher selects the activities that provide a range of learning experiences for the students. What is necessary now is for teachers to work together to ensure that higher order thinking skills become a formalised part of the mathematics syllabus at the start of each year or semester. In that way, rather than having the ad hoc development of thinking skills that is currently the situation, a direction can be adopted that will lead the students and teachers to achieve clearly defined goals.

Journal tasks can be devised that reflect and incorporate the learning outcomes intended. Further, the assessment of those tasks can be included in the reporting procedures of the Mathematics faculty. New tasks do not necessarily have to be created. Many activities already being undertaken in Mathematics classrooms lend themselves to the development of higher order thinking skills. Adapting those activities would be the most sensible place to begin designing a thinking curriculum that makes use of a Mathematics thinking journal. For example, the following activities from the Year 7 syllabus can be adapted to formalise the thinking skills required.

The following Year 9 activities can also be adapted:

Area of study	Activity	Journal task	Assessment category
Fractions	Chocky Fractions: On three tables, one, two or three blocks of chocolate are placed. The chocolate will be evenly divided among the students who sit at the table. Students choose a table with the intention of maximising the amount of chocolate received.	At the beginning of the activity, explain why you will choose a particular table. After the activity, explain whether your decision was the best.	Experiment/ Investigate Compare/ Contrast
Probability	Greedy Pig.	Write up the activity as a scientific experiment, including Aim, Method, Results, Conclusion.	Experiment/ Investigate Conclude/ Explain/Justify
Number Systems	Why was zero invented? Discussion of the history of zero.	Write an answer to the question 'Which is more important, zero or one?'	Conclude/ Explain/Justify

Area of study	Activity	Journal task	Assessment category
Trigonometry	Sliding ladder experiment	Write up this experiment as a scientific prac, using the headings Aim, Method, Results, Conclusion.	Experiment/ Investigate Conclude/ Explain/Justify
Quadratic functions	Graphmatica investigation	Compare and contrast 8 graphs. What conclusions can you draw?	Compare/ Contrast Conclude/ Explain/Justify
Trigonometry	Pythagoras' Theorem	What is the connection between the diagram and Pythagoras' Theorem?	Compare/ Contrast

Along with careful planning regarding its use, the introduction of the mathematics thinking journal would require easy initial activities and regular use to enable students to build up skills and understanding. The students need to be familiar with the purpose of the journal so that they can feel comfortable using it. As this familiarity develops, the journal tasks can become more abstract in their demands. Furthermore, teachers must allow flexible presentation formats within the journals. Diagrams, words and images should all be encouraged so that students develop a personal connection with the work they complete in the journal. One of the intentions of the journal is to encourage students to participate in reflective thinking, so it may be useful to include frequent, non-assessed reflective thinking tasks where students are asked to reflect on what they have learnt and how they feel about their learning. By writing down their thinking processes, students will reflect on and synthesise their learning. The aim of this activity is lofty, it is to develop deep learning:

Deep learning occurs when the learner seeks to make sense of what is learnt and require that the information received is processed; connections are sought between items of information and between learning tasks; and ideas and precepts involved are considered and challenged (Eley & Caygill, 2001, p. 22).

There is a great deal of evidence that mathematics teachers are beginning to incorporate thinking skills in their classrooms. However, the introduction of appropriate activities is mainly ad hoc and their value is not reflected in the assessment processes of the mathematics classroom. The introduction of a mathematics thinking journal has the potential to address these problems and to support students in the learning and thinking skills. Reading students' writing

on arithmetic, geometry, probability and trigonometry has the potential to provide access to students' ideas, reflections, hypotheses, responses, connections and misconceptions. It would be an opportunity for students to learn about their own thinking. Reading students' writing would provide access to students' thinking styles and it would provide an ideal resource for assessment.

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Creating a design and multimedia thinking curriculum

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Abstract

In this chapter Chenery has created a design and multimedia thinking curriculum primarily modelled on Gardner's Multiple Intelligences. He addresses the philosophy underpinning his suggested curriculum plans. As a career or vocation, multimedia and design are major growth areas. Ultimately the successful practitioners in these areas will be well grounded not only in technical skills, but also in the ability to think creatively and maintain an interest and curiosity in the big questions. He believes that motivation and critical learning skills need to be nurtured and an emphasis on learning how to learn is the key.

Introduction

Skills in critical and creative thinking, maintaining curiosity, and finding a range of approaches for dealing with the 'big questions' are essential for the middle years. Ramsey (2001, p. 38) suggested ways of linking pedagogy with the students' own culture:

- Design activities around both teacher and student interest rather than in response to an externally mandated curriculum—curriculum requirements will still be covered.
- Have students undertake collaborative group projects where skills are taught in real contexts rather than a sequence of textbook exercises.
- Focus teaching on the understanding of complex ideas (for both teachers and students) rather than on definitions and facts.

- Use assessment methods that teach and allow students to assess themselves—issues of quality, aesthetics, good design and effectiveness should be at their core.
- Teachers should view themselves as learners. Students respond to this by becoming educators.

An appropriate **learning environment** like the one created by a community of inquiry approach, (see Chapter Two), is vital for the establishment of a thinking classroom.

This includes provision of:

- a supportive, welcoming atmosphere and the room arranged for group discussion,
- areas for private study and group work,
- a stimulating and creative environment, drawing on student involvement in all phases of activity,
- natural light, fresh air and exercise area (particularly useful for computer-based learning), and
- rooms for computer use, interactive group learning, music, and leisure activities.

Resources for learning

These include: books, journals, magazines, libraries, galleries, museums, industry and business contacts, CDs and DVDs, internet, videos, field trips, guest speakers, and industry-related exhibitions and seminars.

Ways of demonstrating learning

These include: writing, drawing, photography, music, multimedia, videos, exhibitions, group discussions, performances, interviews, personal or group websites, learning journals, visual diaries, portfolios, and CD-ROMs or disks.

Gardner's model

Gardner's Multiple Intelligences (MI) model, as a planning device, offers a framework for different ways of learning. It allows the teacher or teaching team to focus on approaches they may not ordinarily consider in the context of their

particular subject area. The model (see Chapter One) provides a dynamic learning approach that considers individual student learning styles and includes students who have traditionally felt left out. It provides the curriculum designer with an exceptional model for integrating a variety of learning styles and developing rich tasks.

The eight intelligences describe different ways of knowing and understanding the world by drawing on a variety of skills and thinking methods. Gardner claims that at least one of the intelligences dominates each student's learning process.

These intelligences interact when a task is being completed and can all be learned and enhanced over time.

Information technology and design

Information technology is constantly changing. Even very young students are quickly developing and adapting their skills both inside and outside school. Teachers are struggling to keep up with the rapid changes in software and students often find themselves in the position where they know more than their teacher.

Even within a more specialised learning situation such as design and multimedia, the Multiple Intelligences model provides a dynamic approach to setting rich tasks, a range of outcomes and a holistic approach to assessment. It could be argued that a course in design will attract students who have already developed their visual/spatial intelligence and therefore have already found their preferred way of learning. Why then introduce the other intelligences when they may be a far less effective method of learning for these students?

Success in an area such as design draws on not only visual/spatial intelligences, but also verbal/linguistic skills for communicating in text and expressing oneself effectively. A successful designer will deal with a wide range of different businesses and interests requiring a broad range of knowledge and skills. Multimedia, by definition, requires ability particularly in verbal/linguistic, visual/spatial, logical/mathematical, musical/rhythmic, interpersonal and intrapersonal solutions.

The unit below is aimed at creating a solid knowledge and skill base in the area of design and communications. It allows the students some insight into a possible career in this field. Use and availability of equipment will be a major factor in the planning stages. Smaller group sessions would be an effective way to deal with limited resources and would encourage cooperation, teamwork and organisational skills.

The following task is aimed at identifying individual student's skills and developing these skills as part of a group. As the tasks require a variety of technical skills, they will be more effectively dealt with by teaching teams. This will also mean that both the teachers and students need to plan as a group.

<i>Topic</i>	<i>What are my skills?</i>
<i>Topic objective</i>	Create a website to promote the work of the group.
<i>Guiding questions</i>	What are our skills? What are the roles of the group members? What materials do we need? What is the best way to promote our skills? What are the best contemporary examples of this kind of website?

Curriculum plan

<i>Gardner's Intelligences</i>	<i>Tasks and activities</i>	<i>Portfolio and assessment</i>
Verbal/Linguistic	discussion, presentation, reviewing, captions and content	involvement and contribution
Logic/Mathematical	planning, data collection, market research, translating statistics	report of data and conclusions
Visual/Spatial	collection of material, site design, creation of images, page layout	group website and member's portfolios
Bodily/Kinaesthetic	client/applicant/ employer role play, design an exercise program for computer operators, video or photograph a movement sequence to use on site	video, performance and peer assessment
Musical/Rhythmic	design a soundtrack on 3 themes, create 10 sound effects	recording on CD or disk
Interpersonal	allocate responsibilities within the group, interview an expert, devise a group name and slogan	report, text of interview
Intrapersonal	self-assessment exercises, self-promotion component, visual diary of progress	support portfolio and report
Naturalist	collect images from at least 3 different environments, report on a related industry	images, samples and report

Assessment

Generally speaking, the assessment for the tasks above needs to be based on a variety of criteria in order to be accurate. A range of presentation mediums and methods have been set for submission: a component of self-assessment, peer assessment, and outside professional review, and grading by teachers of both support work and the final project. Assessment methods that teach and allow students to assess themselves—issues of quality, aesthetics, good design and effectiveness—should be at the core of a thinking curriculum (Ramsey, 2001, p. 38). The medium chosen for presentation should be relevant to the task and enhance the technical skills of the students. Care should be taken to ensure the assessors

are able to access the material, for example, correct file naming for digital material and thorough testing of the final presentation.

The thinking processes outlined by Bloom can also be considered when designing the framework for assessment. The teacher's role as mentor means that his or her assessment has great supportive potential as well as adding an objective view to the students' own critical view of their work. Results should reflect strengths and weaknesses and be provided as progressive feedback over the duration of the course.

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Identifying and assessing a thinking-based design curriculum

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Abstract

In this chapter Saddington, a graphic design teacher, argues for a thinking-based design curriculum. He believes the function of design in society is too important to be driven by industry and information technology. The curriculum he proposes is based on a combination of Queensland's New Basics curriculum, Atkin's Integral Mind and the Illinois Institute of Technology's research and development models. The basis of his curriculum model is a triad of concepts, multi-level projects, and research and development methods. This replaces the traditional outcome-based project modules.

Thinking about information technology

As the complexity of the world increases, education must retain the focus on the human issues rather than allowing technical matters to dominate. Interaction with technology and the level at which this should occur is probably the most pressing issue in education today. However, there is a delicate balance to be struck between information technology training, the immediate or perceived needs of industry, and the future needs of students and the community. The problem with information technology lies not in how to do certain things, but what to do and why. If information technology curricula focus on How? then students will be poorly prepared for conceptual challenges. Today the authority of the teacher no longer lies on being the one who knows, rather it is in being the one who knows about how to foster deep understanding of big ideas and powerful processes.

In a thinking-focused curriculum, the task itself, or the method of achieving the result, is at the base of the process. Method is driven by the conceptual factors of Why? and What?

Method-focused	Thinking-focused
Method	Why? What?
Content	Method/Content

Atkin (1993) suggested that the teacher's role must shift from trainer to facilitator. Students should be assisted to move into a constant informal research mentality where the solution to everyday tasks lies not in knowing the exact answer, but in knowing how to find out the answer. Beyond a general technical knowledge of the principles behind the use of specific information technology software, students should familiarise themselves with software commands mainly on a need to know basis. This is because the overwhelming complexity of modern software applications constantly threatens to swamp the thinking component.

It is imperative that students are exposed to appropriate resources and methodologies for identifying new resources. They must be confident that time-efficient solutions to technical problems are only a mouse-click away. There is an illogical but pervasive tendency for students to struggle with technical problems for hours rather than spend five minutes searching the 'Help' resources on screen. As a lingering vestige of chalk and talk training methods, many students prefer to ask the teacher when confronted with a technical problem. A few minutes spent in demonstrating the ease of use of on-screen resources in technical problem solving is a much better investment of teaching time than demonstrating the method outright.

The internet has a crucial role to play here, not only as a resource in its own right, but also as a source of information on resources that would have necessitated travel or unwieldy telephone contact in the past. Examples of this are:

- Internet access to public library databases and collection records,
- corporate web databases both as retail shop fronts and as 'user-pays' resources, and
- identifying and downloading appropriate shareware from the public domain.

To enable this paradigm shift towards informal research, subjects should include both traditional and web-based research skills.

In any group of students, some will be more computer literate, and these students can be encouraged to share their knowledge. Projects can be constructed

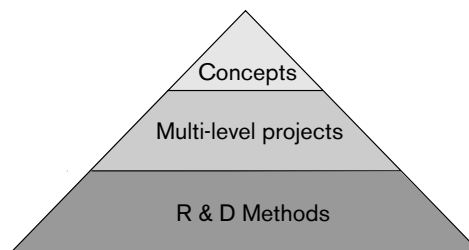
deliberately to encourage this process, again with a research bias, so that all students, regardless of their original knowledge level, are required to learn something new, sharing this with the others. Project construction can also contribute to the self-esteem of weaker students, who feel as though they have contributed something to the group. Students should be encouraged in this way to work together with colleagues rather than struggle along unaided. Their formative experiences of the design process should be collaborative rather than competitive.

Thinking modes

As discussed in previous chapters, students and staff should be aware of the existence of different learning and thinking modes (Bloom, Gardner, Herrmann, Atkin etc). Activities need to help them to both move outside their natural dominance area (for example, visual thinking) and contribute to group activities by using their particular thinking talents. General and interactive thinking are important in many fields. Students can be encouraged to engage and collaborate with people in a variety of situations outside the school environment where thinking idioms may be extremely limited.

A design-based model

Design's functions include informing, questioning, delighting, or even shocking, and creative designers not only know what they are doing, but why. The function of design in society is too important to be driven entirely by the vagaries of current industry imperatives. The curriculum I propose is based on a combination of Queensland's New Basics curriculum (2000) and Atkin's Integral Mind Curriculum (1993). In the Queensland model, a triad consisting of Concepts, Multi-level Projects and Research and Development (R&D) Methods replaces traditional outcome-based project modules.



Subjects in the Integral Mind Curriculum are based on a paradigm shift from How? and What? to Why? This involves a two-stage evolution as outlined below. In design, to achieve the integral mind, students will need to expand their inquiry outside the traditional disciplines of graphic design (How do we create design?). They need to take in the myriad aspects of communication in the modern world (What is design?) and the human condition in general (Why do we create/design?).

The traditional tools used to create design are mostly craft or skill areas (typography, graphic design, print technology, drawing, computer skills, illustration,

history, writing). However, these can be learnt in tandem with, or in the service of, more intellectually driven outcomes.

The first stage of this shift should be to refocus attention on ‘media’ in its broadest sense, that is, the vehicles that carry design and general messages in our culture. Implicit in the question What and where is design? is the understanding that any such list may be incomplete and that new opportunities may exist.

What and where is design?

- Newspapers
- Posters and billboards
- Architecture
- Internet
- Multimedia
- Packaging
- Exhibition/shop/corporate space
- Public space
- Products
- Books, Magazines
- Outdoor furniture
- Signage
- Public information
- Corporate information

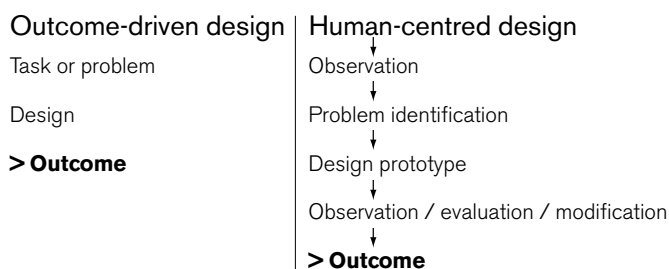
In the second stage of curriculum change, attention moves from design media to fundamental human needs, stimulating a design paradigm driven by intelligence and empathy. Human systems are the reason for things to exist and they drive all creativity and industry. Students can examine four main abstract concepts—the individual, the group, trade and relativity—independent of specific design disciplines. Design skills will be used to bring out aspects of these concepts through a subset of multi-level project titles. Projects may be executed within an existing medium like those in the preceding list, but new uses for design may be suggested by the deliberate amorphousness of the project titles. The idea is for students to examine not only what design is today, but also what it could be in the broader context of human communication and human thought.

Concepts	Multi-level projects	Concepts	Multi-level projects
<i>The Individual</i>	Life skills Intelligence Consciousness Emotions Sensations	<i>The Group</i>	Politics Ethics Language Religion Family Conflict
<i>Trade</i>	Risk Advertising Resources Currency Buying Selling Wealth Poverty	<i>Relativity</i>	Velocity Order Chaos Environment Innovation Process Space Time

Identifying and assessing project activities

Progressive educational institutions such as the Illinois Institute of Technology (IIT), sometimes called the ‘New Bauhaus’ are beginning to apply more empirical methods to the creation and assessment of design. **The research and development models** below are based on the IIT system and form the basis of day-to-day project work for this curriculum model. Using a method known as human-centred design, IIT turns traditional thinking on its head. Rather than designers foisting solutions upon users, Human-Centred Design allows users to speak directly and indirectly through various research methods.

These methods are designed to gather intimate qualitative and quantitative data on human behaviours and needs. Information gathered becomes the impetus for new designs. This differs from the traditional methods of design education, where students are presented with a fixed outcome-based project and use aesthetic experimentation under the banner of creativity to achieve a result. In Human-Centred Design, even the initial problem itself is established by research. The final solution is more a product of democracy than an austere gesture by an individual.



The research and development methods contained within IIT's human-centred design challenges the traditional use of elitist terms and notions such as inspiration, creativity and genius. They seek to systematise the creative process to serve human needs.

Eleven methods, drawn partially from IIT's human-centred design, and which form the core framework for identifying and assessing project activities, are outlined below. Note that skills such as the ability to use a computer or to make a three-dimensional model are incorporated seamlessly into each method rather than existing as discreet subject areas.

- **Ethnographic observation.** This method is borrowed from social science research. Students utilise this method to understand unarticulated needs and issues that users of particular products, environments, software, and systems have in order to create innovative design solutions.
- **Video ethnography.** This offers a way to capture human behaviour in the context of the person's natural environment and is a means of gaining insights about user behaviour and needs. Videotaping allows students to view and re-view user behaviour. The analysis of the tapes is used to present insights and implications for design solutions. Not only is videotaping essential at the beginning of the design process as needs are identified, but it is also key throughout the process as students gain an understanding of a particular user context and as prototypes are developed.
- **Disposable camera studies.** Using this approach students can gain insights about places they cannot access, such as people's homes. Because they are so inexpensive, students can give disposable cameras to users so they can document their environments and objects in context. Because this method involves the subjectivity of the participants instead of the student doing the research, students get a glimpse of life through the users' eyes.
- **Observation with prototypes.** This involves students giving their prototypes to users as a means of observing typical interactions. Students use video ethnography and field notes to document their observations. The insights they gain allow them to determine what works, or doesn't work, and why, so they can refine their concepts.
- **New human factors.** This includes methods to understand the broad terrain of human needs in a methodical way, the needs people may not even know they have. These processes extend far beyond the focus groups and surveys applied in traditional marketing. Employing the principles of human factors, in combination with ethnographic observation methods, can help design teams create value-rich solutions that not only satisfy but also delight their users.

- **Cognitive factors.** Understanding cognitive human factors helps students design in response to cognitive patterns, for example, how people receive, process, and understand information. Only by knowing how people best absorb information, attach meaning, and develop memory can we present effectively. This becomes critical as we incorporate increasingly complex information into design.
- **Social factors.** Understanding social human factors helps students create products, environments, software, and systems that enable people to work more effectively either individually or as teams. This understanding is increasingly vital to the emerging networked society and the growing use of empowered teams as the cornerstone of modern enterprises.
- **Cultural factors.** Understanding cultural human factors helps design teams avoid creation of products, environments, software, and systems that conflict with values and patterns of behaviour.
- **Lateral thinking.** A cognitive method developed by Edward de Bono. Lateral thinking seeks to solve problems by unorthodox and apparently illogical methods, and uses available knowledge in the construction of new combinations of ideas.
- **Williams' taxonomy.** A model for creativity consisting of a hierarchy of cognitive and affective thinking levels designed to stimulate spatial, flexible, spontaneous, analogical and divergent problem solving.
- **Prototyping** produces a succession of mock-ups to home in on a concept. Students use a combination of behavioural and conceptual prototypes to reach their final designs.

Behavioural prototypes demonstrate how a new design may function rather than how it may look. These prototypes may be 3-D functional models, paper prototypes of interfaces, or software-based interface designs that can simulate interaction. Students create behavioural prototypes so they can observe typical user interaction early in the design process. The insights students gain from such observations allow them to determine what works, what doesn't, and why.

Conceptual prototypes represent what products, environments, and software may look like without necessarily simulating functions. Prototypes may be concept sketches, concept renderings, 3-D appearance models, paper prototypes of interface designs, or software prototypes that show screen designs. Students create them so people won't have to rely on verbal descriptions that lead to a variety of interpretations.

Assessment

The advent of concept-driven design education rather than skill-based education will change the method of assessment. It will not be sufficient for teachers to merely assign a numerical mark based on a student's competency at creating say, a brochure. Questions about the reasons for the brochure's existence, its form and relevancy will be part of the assessment process. Concept-based projects, by definition, are characterised by complexity. By enabling variable and creative responses, they cater to student diversity without compromising standards. Their content is imprecise, maintaining validity while not demanding the representation of the same content by all students. And for these reasons they do not lend themselves to precise quantified or analytical grading but rather to holistic grading (Queensland New Basics 2000).

Newmann et al. (1996) suggest a useful model for measuring authentic achievement that may be used on an informal basis to assist teachers grappling with holistic assessment:

A. Construction of knowledge

Organisation of information

Consideration of alternatives

B. Disciplined enquiry

Content

Process

Written communication

C. Value beyond school

Problem connected to the world beyond the school

Audience beyond the school

Obviously the discretion of the teacher in assessing projects will be important, but the systematic nature of the Queensland Research and Development (R&D) methods means this discretion will not be an overwhelming responsibility. R&D methods should contribute to a clearly defined notion of the student's effectiveness in responding to the conceptual demands of the multi-level project. In addition, projects will require the students to submit a written report on their success in identifying and solving problems. Teachers will make a holistic assessment based partially upon the student's use of R&D methods, partially on their response to the multi-level project, and partially on their understanding of what they have learned, expressed through the written report.

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Designing a Thinking Curriculum

The revised edition of *Designing a Thinking Curriculum* responds to the challenge of disengagement in the middle years of schooling by providing teachers and administrators with ideas for the implementation of a thinking curriculum in their schools.

Teachers, teacher educators and curriculum consultants describe how they have been influenced by theorists, their use of appropriate cognitive theories, and strategies they have developed that will assist students to develop higher order thinking skills. Ways of accommodating a variety of learning styles and establishing supportive school structures are also presented.

Teachers in this book show how they have

- modeled their curricula around ideas and issues generated by students
- linked substantive, real problems to curriculum content
- ensured that students achieve deep knowledge and understanding
- fostered higher order thinking through the use of technology, creative thinking, the visual arts and mathematical and scientific ideas.

Designing a Thinking Curriculum will inspire, inform and motivate teachers looking to implement a thinking curriculum in the middle years of schooling. It is a practical first-hand account of the experiences of teaching colleagues based on sound pedagogy.

Author-Editor and Contributors

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