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DEVELOPING SUCCESSFUL LIFE-LONG LEARNING SKILLS

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ABSTRACT

Effective teachers believe that all children can become successful learners through the provision of appropriate and inclusive school learning experiences which optimise their capacity to think and learn. This outcome appears more likely in schools where supportive classroom communities are encouraged. It is these experiences, teachers believe, that enable children to increase control over their learning and equip them with life-long learning skills considered necessary for meeting the challenges of living in a complex, fast-changing world.

Even though progressive pedagogy recognises the need to cultivate independent and reflective thought in classrooms, there appear to be significant differences in current `common' and `best' practice, preventing its potential being realised in children.

This document reviews current educational practice based on our understanding of the ways children develop, think and learn. An analysis of the literature discusses the many theories and propositions that have led to this position. The development of contemporary theories of learning are examined, as well as the contribution of language to cognitive development. Cognitive processing, along with effective processing strategies, are examined in the light of competent thinking. Consideration is given to a range of thinking skills together with their effective application. The assessment and evaluation of children's thinking is also discussed.

From the literature examined, a selection of appropriate teaching and learning strategies are made. These strategies are intended to maximise the learning and thinking capacity of all children, and equip them with skills that will enable them to become independent, life-long learners and thinkers.

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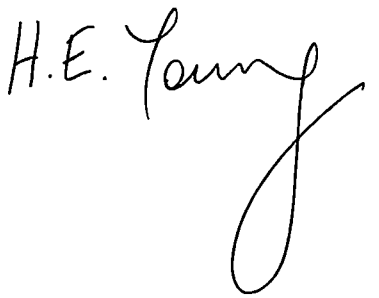
I, Helen E. Young, acknowledge that this Education Project contains no material which has been accepted for the award of any other higher degree in any Tertiary Institution and that, to the best of my knowledge and belief, this project contains no material previously published or written by another person except when due reference is made in the text of the project.



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In a school that is a home for the mind there is an inherent faith that all people can continue to improve their intellectual capacities throughout life; that learning to think is as valid a goal for the `at risk', handicapped, the disadvantaged and the foreign-speaking as it is for the `gifted and talented' and that all of us have the potential for even greater creativity and intellectual power.

Arthur L. Costa 1992, p.2.

1. INTRODUCTION

Effective teachers believe that all children can become successful learners in classrooms and that the skills they learn at school will prepare them to further improve their intellectual capacity throughout life. These are the necessary attributes, they claim, that will enable individuals to cope with, adapt to and improve both their lives and the lives of others in an increasingly diverse, complex and fast-changing world.

The purpose of education and schooling is to serve the best interests of the child. Accordingly, the role of schools and teachers is to recognise the needs of the individual and to provide appropriate learning experiences that will maximise the capacity of all children to think and learn. In order for children to become worthwhile human beings capable of worthwhile human endeavour, schools need to provide learning experiences that recognise self-development, intellectual empowerment and lifelong learning as core values.

As teachers, we need to be vitally concerned with maximising the potential of all children by providing opportunities for optimising their capacity to learn and think. However, understandings of the nature and processes of learning and thinking and the relationship between them vary considerably among educational theorists, cognitive psychologists, philosophers, teachers and parents. Children appear to develop, learn and think in many different ways requiring teachers to provide a wide variety of teaching and learning experiences in order to promote successful learning for all children. As well, our current views of knowledge and its acquisition differ significantly from past

views. Behaviouralist views of learning were based on the view that knowledge was a static, separate and objective entity which existed prior to and independent of the learner, and that learning was the gaining of information and facts. However, currently held views see knowledge as dynamic and ever-changing; a process as well as a product. Knowledge production involves the interaction of the learner with other learners, the teacher, the content and the physical environment.

Tasmanian Education, particularly at the primary school level, is used as the context of this paper. Documents released by the Department of the Education and Arts, and as it was formerly known, The Education Department of Tasmania are used to highlight the changes and developments that have taken place in Tasmanian schools in the last 50 years.

There have emerged a variety of images of learning and many assumptions made about it. Confucius analects believe that

> Learning without thought is labour lost,
> Thought without learning is perilous.
>
> Evans, 1991, p. 1.

Many factors appear to contribute to learning with many significant changes occurring during the learning process. Young children are often assumed to think differently to older children, especially in regard to their ability for complex learning and abstract reasoning. People's views on the ways learning is measured vary significantly, from a variety of quantitative to qualitative methods. Most people would agree that learning involves change and growth. They are also likely to agree that the major role of schools is to equip children with knowledge, skills and attitudes necessary for their future functioning in the wider community.

It appears that the different interpretations of learning and thinking are influenced by one's view of knowledge. Nickerson, Perkins and Smith (1985, p.1) state that `on one hand, thinking is essential to the acquisition of knowledge, and on the other, knowledge is essential to thinking'. What then, is the relationship between learning, thinking and knowledge? Cognitive psychologists suggest that knowledge is stored by the learner as a network of concepts and constructs. Constructivist theory suggests learning occurs through the making of connections between new information and the learner's network of knowledge in order to increase the complexity or sophistication of a concept. It is through this active construction in relation to environmental stimuli and the continual adaptive process that organises the learner's experiential world that learning takes place. Thinking is the active process which facilitates the making of connections and thus allows learning to take place. Hence effective teaching should facilitate these connections (Department of Education and the Arts, Tasmania, 1991).

Past teaching practices have been based on a particular view of knowledge and a particular view of the way children learn. Learning under these conditions has been prescriptive and teacher directed, with knowledge being transmitted from the teacher to the learner. Learners, then, have been passive recipients of knowledge. Success has been generally indicated by test scores, and those children with good memories for curriculum content have usually been considered successful. These views complemented the view that the overall purpose of schooling was to provide individuals with the necessary knowledge and skills for specific tasks in the work force.

It is more recently acknowledged (Rowe, 1991) that not only should teachers be concerned with learning outcomes, but with learning processes as well, since it is these processes or cognitive skills that enable individuals to adapt to altered situations, tackle new tasks, develop new skills and solve new

problems. It is generally acknowledged that individuals who are capable of these skills are likely to become successful learners. They are able to think for themselves, to take active control of how they go about their learning, and are likely to become independent and self-fulfilled in their intellectual, vocational, social, ethical and personal lives.

Taking control over one's learning involves knowing how one is thinking, how one knows, how one learns or does not learn, and how one goes about dealing with particular questions or tasks. Often this will lead to knowing when and where to apply particular skills, rules and pieces of knowledge. The learner is an active agent who is able to reflect upon, monitor, and influence his or her own learning.

It is also assumed that thinking and learning can be taught and that a better understanding by students and teachers of the processes involved in thinking and learning can help to improve intellectual ability and performance (Rowe,1991; Langrehr, 1993a). No longer is intelligence considered as fixed, but able to be changed and developed. In fact, it is now considered that everyone is capable of intelligent behaviour. Much research on students and their skills and processes support this (Rowe, 1991; Langrehr,1993a). Just as formal training produces mastery in gymnastic skills, so does formal instruction in thinking skills produce mastery in thinking ability. The value of intelligent behaviour is seen in terms of co-operative effort, rather than merely as with individuals.

Important also to successful learning and thinking are effective communication skills. These may be fostered through a wide variety of conversational experiences (Clay, 1991; Coles, 1994). It is these experiences, they claim, that foster language development and extend children's control of their language and thinking. Language is essential for

questioning, reasoning, hypothesising, theorising, and making decisions. Cognitive functioning is developed through these processes. Through communities of enquiry, children are better able to understand differing points of view, based on children's differing backgrounds and experience, as they work towards a consensus in their ideas and understandings.

Success also comes from being valued as an individual within a supportive community, and being recognised for one's uniqueness. Having a positive self-concept and its associated healthy level of confidence are crucial to this valuing.

Success for all children is also promoted and encouraged through approaches to teaching and learning which are inclusive rather than exclusive. Effective teachers acknowledge the background, knowledge, past experience, developmental considerations, and preferred learning styles of children. Equal access to learning is given regardless of gender, socio-economic status, race and cultural background, religion, geographical location, and physical and mental attributes. The role of teachers, then, is to assist all children to reach new levels of understanding and acquire more complex skills.

As well, successful learning is achieved through meaningful learning, that is, raising children's awareness of the many ways of knowing and the many ways of responding to their world. Not only do children need to become aware of their own preferred learning style or a particular way of knowing, but the appropriateness of various learning styles in particular learning situations.

Of paramout importance to all aspects of successful learning and thinking are well-developed language skills, since language enables thinking. Language is the tool by which individuals abstract meaning and communicate ideas (Bruner in Brady, 1985). Thought, according to Bruner, is `internalised

language' (Brady,1985). It seems that the more control one has over their language, the more control one has over their own thinking (Clay,1991; Coles, 1994).

It is these beliefs which form the philosophical basis of the socio-constructivist theory of learning, which is currently informing our teaching practices in schools. It sees children as `powerful, rich, competent and strong' and capable of making significant decisions based on an understanding of their own needs (New & Mallory, 1994, p.188). They all have their own ideas and capacities which they draw on in becoming active learners. They make their own choices, know and express their own needs and desires, and participate in the construction of their own education. The learner therefore makes a contribution to his own learning and development. All children are respected and valued in their own right, regardless of the nature or the cause of their differences, thus are supported by inclusive teaching practices.

Knowledge is socially and culturally constructed, as children come to know reality, that is, the rites and routines, responsibilities and possibilities contained in families, schools and society. Children not only learn from the cultural context in which they are embedded, but also contribute to the development, the maintenance and the development of that culture. Not only do children learn from their socio-cultural context, but also from the social exchanges which take place within them. Collective intelligence is valued above individual intelligence, with emphasis on enterprise through group decision-making.

What then are the implications for schools and teachers in providing for this kind of learning? In what ways can schools contribute to the growth of successful learning, powerful thinking and intelligent behaviour? What are the

teaching and learning strategies that optimise children's learning and thinking? In what ways can teachers accommodate the different knowledge, experiences, developmental levels and learning styles of children and provide a variety of ways in which to learn? In what ways can all children's learning be valued?

What is required are classroom communities where teachers and students are interdependent learners. Central to success are the learning experiences, settings and interactions within the learning setting. These should help learners to increase control over their learning and help them to develop new and more efficient skills, styles and strategies for learning as they pursue learning goals. Teachers need to foster the interests of children as problem solvers, decision-makers and processors of information in preparation for living and working in an increasingly complex world.

Socio-constructivist learning theory supports teaching strategies that provide for communities of learners; communities consisting of routines, rites and rituals that encourage participation by all individuals and at the same time promoting a sense of belonging to a larger group. Through language and joint activity, children of diverse abilities and experience co-construct understandings in an atmosphere of trust and challenge, where risk-taking and trialing are seen as an integral part of learning.

The National Statements and Profiles for Australian Schools, released over the last 3 years since 1991 by the Australian Educational Council, reflect current philosophies about the ways children develop, learn and think. They also provide guidelines to assist teachers in catering for the future needs of children in our rapidly changing society. These statements and profiles are based on ten common and agreed national goals for schooling in Australia, including statements which provide a common framework for curriculum

development in eight broad areas of learning - English, mathematics, science, technology, languages other than English, health and physical education, studies of society and environment, and the arts.

The statements in each learning area outline the essential elements and a sequence for developing knowledge and skills, and teaching methods which are likely to encourage productive learning strategies and positive attitudes in each learning area. It is suggested that children's developments are measured in terms of desirable outcomes, according to levels of development.

The statements recognise the importance of curricula that respond to changing circumstances, and the varying needs and abilities of individual children. Not only do children need knowledge, but also ways in which to use that knowledge. For it is these that will help meet the demands of daily living in a rapidly changing world. The National Statements and Profiles document states that children need to develop the competence, confidence and interest in all recognised learning areas. For it is these competences, the document claims, that will enable children to become life-long learners. It also claims the need to broaden access and promote success in the interests of social justice, civic responsibilities, maintenance of Australia's health, environment, and economic well-being.

The Tasmanian Framework For Curriculum Provision, K-12, (Department of Education and the Arts, 1993) describes a similar way of devising appropriate curricula for successful learning. Personal, linguistic, rational, creative and kinaesthetic capabilities are woven through the eight learning areas to form the basis of a teaching program.

Current philosophies of learning and children's needs are also reflected in the Key Competences Statement (Department of Employment, Education and

Training, 1993), developed collaboratively by Commonwealth, State and Territory governments, teachers, parents, business, industry and union representatives throughout Australia. Eight broad-based skills are recognised as essential to children for work, education and life. They include collecting, analysing and organising information; communicating ideas and information, planning and organising activities; working with others and in teams; using mathematical ideas and concepts; solving problems; using technology and cultural understandings.

Yet even though progressive pedagogy recognises the need to cultivate independent and reflective thought in classrooms, there appear to be significant differences in current `common' and `best' teaching practice, which are preventing this potential being realised in children. For example, Coles (1994) claims that the dominant pattern of instruction is still teacher-centred and the dominant mode of classroom organisation is teacher talk.

The purpose of this document is to review the many beliefs and understandings of the ways children develop, learn and think in order to provide insights that will enlighten future teaching, and contribute to maximising the potential of all children in their capacity to learn, as well as preparing them as life-long learners and thinkers. Initially, current thinking on various aspects of children's learning and thinking will be explored and investigated through reviews of literature based on recent research studies and findings. These will also be examined in the light of current `common practice' and contemporary `best practice'. Following will be an examination of the ways used to `observe' and evaluate cognitive and metacognitive processes operating in children during regular classroom experiences, along with clues that suggest increasing inner control of these processes. Then, an attempt will be made to synthesise the findings on successful learning and

effective thinking into a practical repertoire of teaching and learning strategies.

Chapter 2 examines contemporary theories of learning. These are intended to help explain the many and varied understandings about the ways children develop, learn and think. Aspects such as the different ways of seeing the learner, the nature and processes of learning, our differing views of knowledge and its construction, intelligence, environmental factors, cognitive developmental factors, and the significance of interacting with others are rigorously examined.

Chapter 3 assesses the contribution of language to cognitive development. The ways in which language enables individuals to reason, to pose and answer questions, to hypothesise, to theorise and to make decisions are investigated. The importance of using familiar language is examined, especially for young children, in order to de-centre their thinking. An examination is also made of the importance of reading in the development of cognitive functioning. The importance of conversation when used in co-operative learning situations is also examined.

Chapter 4 examines cognitive processing (thinking) in detail; in particular the ways the brain assimilates, processes and stores information and the factors which lead to greater accessibility, flexibility, and transferability of concepts and ideas. The chapter also considers the role that evolution has played in the functioning of the brain. Alternative ways of understanding how the brain processes information are offered through an examination of various processing modes. The differing learning and thinking styles of individuals - the different ways of knowing and responding to the world are then examined as they relate to these processing modes. The notion of multiple intelligences is investigated. Thought is then given to the ways in which meaningful

learning is understood and how it might be achieved. To conclude this chapter, various aspects are considered which may account for individual differences in thinking and learning.

Chapter 5 investigates the various meanings of what it is to be a successful learner and/or competent thinker and the ways this might be possible. A range of competencies that these individuals exhibit, and how they relate to competent performance are examined through contemporary models of competent thinking, in particular, models related to the use of effective strategies, and the factors that promote their effective use. These factors are further highlighted through a comparison of successful and `learning-disabled' students. The possibilities for encouraging successful learning in all children are considered.

Chapter 6 looks at the range of thinking skills considered to be the `building blocks' of thinking and whether they are specific to particular situations or can be generally applied to diverse fields. The ways these thinking skills assist in problem solving, decision-making, and information processing are investigated. An examination is made of the extent to which they are achievable in all individuals and also the extent to which they may be taught in schools. For their most effective use, a consideration is made of whether thinking skills need to be taught in separate programs or whether they can be integrated into the general curriculum.

Chapter 7 is directed towards understanding ways of `observing' learning and thinking processes in children during their day-to-day activities in the classroom. For this appears to be an important aspect in assessment and evaluation. As well as examining a variety of `observational' methods, the factors involved in young children learning to read and indicators of their increasing inner control over the reading process are also included.

Chapter 8 attempts to bring together the findings of the previous chapters into a teaching framework containing appropriate and effective teaching and learning strategies. These strategies are intended to maximise the learning and thinking capacity of all children, and equip them with skills that will enable them to become independent, life-long learners and thinkers.

Chapter 9 contains a summary of the salient aspects in understanding successful learning and teaching. Suggestions are then given of the ways that changes may be made that will facilitate effective teaching practices in the future.

This paper provides a general view of the enormous and complex subject of children's thinking and learning. The particular areas for investigation and review were chosen for their ability to provide clearer understandings of currently-held views of teaching and learning. Knowledge of these may therefore be used to enlighten future teaching and contribute to maximising the potential of all children to learn as well as preparing them as life-long learners.

2. AN OVERVIEW OF THEORIES OF LEARNING - The Ways Children Learn

> Theories are nets to catch what we call `the world', to rationalise, to explain, and to master it. We endeavour to make the mesh even finer and finer.
>
> Popper,1968. p.59.

There are many and varied understandings about the ways children think, develop and learn. Theories of learning are derived from basic beliefs and values, concepts and ways of thinking about the nature of learning, through sources of knowledge about learning, tradition, wisdom, philosophy, empirical research and learning theory. Each theory is described as `a set of organised principles about particular events in the real world' (Bell-Gredler, 1986, p.3). Theories of learning serve to inform our teaching practices through various models of teaching, and assist in our understanding of processes operating in the classroom that influence children's learning. As teachers we are aware that classes are very complex, interactive and dynamic settings. Current theories of learning emphasise the dynamic and social construction of knowledge through the active interaction of the learner with other learners, the teacher, materials and the physical environment. Through this process, learners increasingly develop more control over their learning, enabling them to become independent learners.

Contemporary theories of learning that have developed over the last 50 years, have suggested many different ways of viewing the learner and knowledge construction. Behaviouralist theories and their implications for classroom practice were dominant in the 1950s and 60s. They emphasised

one-way learning, from expert to novice of prescribed knowledge and skills. These were followed by Cognitive and Cognitive Developmental Theories in the 1970s and 80s, as well as Cultural, Social-Interaction and Transactional Models. A more recent approach to a Cognitive theory of learning is the Constructivist view of learning. This has since been expanded to include a Socio-Cultural element, resulting in the Socio-constructivist view of learning. These theories have increasingly recognised the significance of active learning in which knowledge is constructed socially and culturally. Evidence of all these theories, as well as combinations of them, exist in many contemporary classrooms. This chapter examines these theories in order to highlight the many and varied understandings of learning and thinking and the related teaching practices in evidence in contemporary classrooms.

2.1 Behaviouralist Theories of Learning

Behaviourists generally view the learner as a passive recipient of specific knowledge and skills. Learning is defined as behavioural change and the theory focuses on the factors that influence behaviour. Behavioural change (learning) is functionally related to changes in environmental events or conditions. The Behavioural Model emphasises observable learning of behaviour, rather than the underlying behaviour or `structure'. It focuses on observable relationships between events and responses: Stimulus - Response theories describing learning as the link between stimulus and response (Bell-Greder, 1986; Brady, 1985).

Skinner's theory of Operant Conditioning is one approach of the behaviourists in which Skinner attempts to describe the acquisition of specific behaviours or skills, eg. developing the ability to run, recite, list etc. Behaviour is repeated if reinforced and extinguished if not re-inforced. Behavioural change is based on the manipulation of re-inforcers to elicit appropriate behaviour.

Reinforcement is a consequence that causes behaviour to occur frequently. Hence the basic components of learning are reinforcement, the distribution of practice and response familiarity. In order to encourage complex learning through the development of new and complex patterns of behaviour, complex and subtle contingencies of re-inforcement need to be implemented.

The major features of theories based on behaviourist principles can be summarised as follows. These theories view education as a science, not an art. They focus on actual behaviour and stresses that outcomes can be measured. They regard all behaviour as operating under uniform psychological principles, with an emphasis on the importance of external, ie. environmental forces in producing behaviour. They suggest that undesirable behaviours are learned and therefore can be unlearned. They focus on current existing behaviour and assume that all learning can be demonstrated in behavioural terms. Learning performance is based on specific responding, ie., a specific response to a specific stimulus.

What is the relationship between the learner and knowledge according to the behaviourists? Learning, it appears, is a matter of acquiring static objective knowledge about a `real' world that existed prior to and independent of the learner. Can we separate the individual from the external environment, and can knowledge be objective, being something `out there'? What other limitations, shortcomings and criticisms are there in the behaviourist principles of learning?

Behaviourist learning is limited to the conditions of learning and content. Limited also is its explanation of human activity if we accept the view that individuals are `active, curious, social, human learners' (McKeachie,1976, p.730). It also fails to account for the uniqueness of people and is scientific and mechanical, rather than warm and human.

> I am not compelled to be simply the creation of others, moulded by their expectations, shaped by their demands. . . I am increasingly the architect of self. I am free to will and choose.
>
> Rogers, 1963, pp. 268 - 91.

The main role of the teacher according to behaviourist principles appears to be related to organising the environment to evoke a specific response. A criticism might then be directed at the degree of control that teachers ought to have over students.

Prior to the 1960s, teaching practices in Tasmanian schools reflected behaviourist influences. Schools were seen as places for preparing children for employment, with their main concern being that of teaching children basic levels of literacy and numeracy. In the Curriculum for Primary Schools, 1948, little regard was given to the individuality of each child. In fact, the report indicated that the individual must give way to the demands of society. The then Director of Education, Fletcher, saw much virtue in drill and instruction and social conformity. He supported the learning of basic skills by rote learning:

> aids and teaching devices, whatever their appeal and value, however attractive and elucidating, do not suffice ---- They must be followed and accompanied by conscious effort and intelligent drills, by regular revisions and constant repetitions: *repitio, mater studiorum.*
>
> Curriculum for Primary Schools,1948,p.6.

This system fitted children to common curriculums, devised and implemented statewide, for each grade, and was concerned with teaching basic skills needed for further scholastic success. Grading was according to age, rather than attainment, with teachers dominating the lessons.

2.2 Interactionist Theories of Learning

The `Interactionist' or `Humanist' approach to learning is associated with the theories of Lewin, Rogers, Glasser and others. It stresses the importance of the individual and their interaction with others, as they share their perceptions of reality. Hence learning occurs as the `result of the pupil's interaction with other people and society' (Brady, 1985, p.141).

This interaction, as described by Lapp et. al. (1975) operates between the teacher and pupil, between individual pupils, between the pupil and the content presented and between the pupil's thought and their life. Learning is the outcome of focusing on social, moral, and cultural problems and the process that produces self-aware people for a democratic society. It is concerned with both the cognitive (academic, intellectual problem-solving) and affective (emotional development of self) dimensions of education.

This is described by Lewin (1951) in his field theory as `wholeness' in the learning situation. His theory describes a person's field as not just physical, but psychological. Our behaviour depends on our `life space', and learning occurs when our perception of events in that life space changes. This change of perception is the result of experiences (Lewin, 1951). Hence, wholeness in the learning situation suggests that learning must occur in a natural environment in which the learner's intellectual and emotional needs are recognised through the interaction of others.

Rejecting behaviourism also, and stressing the importance of learner-centred rather than teacher-centred education was Rogers (1951). He acknowledges the importance of the establishment by teachers of warm, supportive environments. This, he stated, could be achieved by establishing `conditions' to govern the relationships between individuals participating in the learning process or experience (1967). Hence the development of both students' and

teachers' self-concepts were an important factor in contributing to the quality of relationships shared by those participating in learning.

Glasser's Reality Theory (1965) supports the interaction of individuals through its principles of reality, responsibility and rights. These, he claims, increase educational performance and self-concept. The importance of the `classroom meeting' focusing on problem-solving as discussion, outlined in Schools Without Failure (1969), further supports this.

The Interactionist approach is also associated with the `Cultural Transmission School'. The learner as a social being gradually becomes adept at using `the tool kit of the culture to express the powers of the mind' (Bruner and Haste, 1987, p.5). The child is seen as `an interior of cultural tools'.

The acquisition and the development of knowledge according to Vygotsky (1962), operates on a social and psychological plane. He argues that the more knowledgeable members of the culture provide the child with the frameworks for interpreting experience. Initially the child acquires knowledge on `the social plane', ie. in situations where mental activity is mediated by a parent or teacher through discussion. Later, the child's use of knowledge becomes increasingly dependent as it moves towards `the psychological plane' and becomes part of his/her individual system for constructing meaning. The organising frameworks are not invented by the child, nor copied directly from adult's instruction. The child and the adult negotiate mutual understandings within categories available to the child and the culture at large.

Language, in this theory, is seen as a powerful tool. Exchanges of dialogue is the means by which the child constructs meaning through interaction with the social world. Language is integrally involved in learning according to

Wertsch (1989). It has a communicative function as a means for expressing thought and also a cognitive function - the vehicle by which the child internalises the concepts of the culture.

The Inquiry method of learning, where the methods and tools of a discipline are offered to students, is a response to the Interaction Model. Children are offered models and cognitive scaffolds in an effort to teach them how knowledge of a given discipline is acquired, eg. map reading in social science or experimentation in science.

Education based on the Interactionist Theory of learning is seen as a social process. By encouraging learning through the development or `knowing' from within, it is argued that it promotes wider and more diverse perspectives, resulting in deeper insights as children share perceptions, listen to others and test and modify their views and values. Learning takes place in a supportive classroom climate where the teacher is non-judgmental and the children's viewpoints are acknowledged. Children are encouraged to generate multiple solutions to given problems and participate in group discussion. These experiences foster positive interpersonal relationships such as respect, friendliness, concern and obligation. Through discussion and problem solving pupils are given opportunities for both intellectual and emotional growth, and, in so doing, attempt to gain more control over their thoughts and actions.

Tasmanian Education began to reflect Interactionist views of learning in the 1960s, with teaching practices moving away from skill and drill towards social and moral development. In 1961, the *Tasmanian Teacher* published an article `Revolution in the Primary School'. It had three sections, `Rights of the Child', `New Outlook' and `Recognition of Needs'. The unknown author wrote of the `old' education giving way `to a more democratic type of education in which the child himself has a say in the content'.

As a result, activity methods and more indirect teaching methods were implemented, in order to cater for the differing needs, interests, and capabilities of individual children. Learners' intellectual and social needs were able to be recognised through their interaction with others. Relationships between children, and between children and teachers, and the content presented changed, as they shared experiences and developed self-concepts.

The report on The Role of School in Society, published in 1967, further highlighted the importance of social and moral development in children's learning. Its Committee argued that the concern of the school should be with the whole person and society, and that this view was `not merely an expression of intent but an acknowledgment of reality' (p.38). They recommended that schools should encourage citizenship and self-cultivation, along with vocational competence in order to `assist all individuals towards a good life in a good society' (p.380). As a result, teachers began adopting problem-centred discussion techniques in dealing with moral and social issues.

2.3 Transaction Theories of Learning

Also involved with both intellectual and affective education are the `progressive' views of learning, also known as `open education', based on pupil-centred learning, and derived from the learning theorists, Dewey, Rousseau, Neill and others. These stress the importance of the self-directed learner, whose learning is based more on the process, learning how to learn, rather than on the product. Learning therefore occurs as the pupil interacts with the human and physical environment and through the changes that occur as the result of that experience (Brady,1985).

Rousseau, whose belief is that the child is initially good, promotes educational practice which allows for pupils to grow in their own way, through activity, with a minimum of teacher intervention, along with encouraging an increased self-awareness.

Dewey, also emphasising self-directed pupil activity, argues for a school based on pupils who are active learners, learning through `experience' in various aspects such as constructive, investigative, social and expressive, with the integration of a wide range of subjects, not just traditional. Dewey argues the importance of integrating both traditional and progressive education - the traditional focusing on the curriculum, and the progressive focusing on the individual.

Neill, in Summerhill (1964), emphasises pupil freedom and democracy, where learning experiences take place in a happy, anxiety-free environment.

Rogers (1967) also stresses the value of experiential learning, as he believes humans have a natural potentiality for learning. Significant learning, he claims, is acquired through doing and through dealing with a subject which is perceived by the student of being relevant to their own purpose. Self-initiated learning, he claims, encourages student responsibility in learning; the development of the whole learner both in intellect and in feelings which, he argues, results in the most pervasive and lasting learning experience. It also promotes creativity through self evaluation, openness to experience and learning as a process and an appreciation by the individual of the process of change.

The significant features of the Transactional Model include Open Education characterised by its openness to change, to new ideas, to curriculum and to feelings between the teacher and children. It emphasises discovery through providing an environment arranged to pose problems and encourage the

discovery of solutions. As well it encourages creativity, along with actualisation, ie. self-fulfilment - a realisation of all that a person is capable of being.

Tasmanian Education in the 1960s and 70s was characterised by a move towards Open Education. It was reflected in architectural design, teaching methods, curriculum, relationships between the school and the community and between pupils and the teacher. In 1961, the Primary School Council was promoting differential teaching. `Syllabuses and method must be directed towards catering for a wide range of abilities, interests and needs' found within the class. Children would not necessarily be doing the same things at the same time. They recommended that discovery methods, especially in maths and science should be implemented, as well as a variety of methods that resulted in deeper understandings. In its Three To Eight Report, 1968, the committee supported the view that an `informal approach leads to improved learning in comparison with more formal methods' (p.3).

In 1980, the Committee on Primary Education (COPE) wrote its report, Primary Education in Tasmania, derived principally from the views of `progressive educators' such as Dewey. His emphasis was on the social and cultural purposes of schooling. Hence the report accepted that schooling should be broad, general and humanistic. Its long term purpose was to assist children in becoming independent, life-long learners. Its ultimate aim was to produce a just society, with self-reliant citizens who chose wisely and acted out of a concern for others.

2.4 Cognitive Theories of Learning

These are mainly concerned with the process of learning or cognition. Cognition is often synonymous with the terms thinking and information processing. The Shorter Oxford English Dictionary (1991, p.337) defines

cognition as `the action or faculty of knowing, knowledge, consciousness or the product of such an action'. Other writers have referred to cognition as any process which allows an organism to know and be aware. It involves perceiving, receiving and judging (Wolman, 1973; Ashman & Conway, 1993, p.32). Most definitions of the verb `to think' range across `a broad array of mental functions from reflection, meditation, and cognition', suggesting passive reception to `mental actions such as conceptualisation and problem solving', implying an active approach (Sigel, 1994). It appears that cognitive processes develop from innate mechanisms that operate to enable individuals to impose meaning and order on their experiences. Information processing emphasises the ways in which humans think and learn through perception, acquisition, organisation, storage, retrieval and evaluation of information, the formation of concepts (representations) and the use of reasoning skills and operations, among them - abstract thinking, induction, deduction, reasoning, sequencing, classification and definition of relationships. `A multiplicity of operations, interpretations and inferences characterise the complex reality constructed by the brain' (Wittrock, 1978, p.101). Each of these processes may work separately or in combination, consciously or unconsciously to meet environmental demands such as problem finding and problem solving.

It is generally accepted by cognitive psychologists that thought involves the manipulation of information represented in the brain. It entails the use of memory and the ability to organise and categorise information. When thinking is conscious we direct our attention to some object or task, monitoring and controlling further actions and thought. This executive control is generally known as metacognition. It is through our becoming aware of the capacity and limitations of our thinking and focusing on our cognitive processes that we can achieve certain goals. The development of thinking, according to many cognitive psychologists, depends on acquiring strategies

for using memory, constructing concepts and representations, integrating simpler processes into more complex ones and manipulating representations to solve problems.

Cognitive theories attempt to explain the ways children think and learn in terms of the range, stages or sequences of mental operations and their products, ie. the forms of representations in their brain. This gives it a developmental perspective. Cognitive theorists view learning as the manipulation of information being presented to us in such a way as it is integrated into our existing knowledge base. Cognitive theorists describe learners as active, constructive processors of information rather than passive receivers of knowledge (consumers of information).

Cognitive theories emphasise cognitive growth in terms of developmental stages. Piaget, Bruner and Werner are cognitive - developmental theorists whose ideas have contributed significantly to understandings of sequential learning. The focus of Jean Piaget's theory of learning is the development of natural thought from birth to adulthood, as it relates to the nature of knowledge. This, he sees, is at the forefront of any consideration of human mental activity. Rather than being an objective entity in the environment, Piaget views knowledge as the continuous interaction between the individual and the environment and learning as the process of this interaction. These internal processes are the means by which a person perceives and structures reality.

> Knowledge is neither a copy of the object nor taking consciousness of *a priori* forms predetermined in the subject, . . . it's a perceptual construction, made by exchanges between the organism and the environment from the biological point of view and its object from the cognitive point of view.
>
> Piaget, in Bringuier, 1980, p.110

An understanding of knowledge therefore requires, according to Piaget, the identification and the description of the various ways that the individual

interacts with the environment. What then, are the processes of knowledge formation and how does one pass from a lesser degree of knowledge to a greater one?

A conception of knowledge as change and a focus on the qualitative differences in the individuals interaction with the environment are two perspectives of Piaget's theory. His theory attempts to analyse and explain intellectual functioning at every stage of human life. Piaget draws on philosophy in his interdisciplinary approach to learning (Bell-Gredler,1986, p.192). Philosophical questions including `What is the nature of knowledge?' and `What is the relationship between the knower and reality?' are asked. Intelligence, Piaget claims, is like a biological organism, living systems that grow and develop. They are both composed of structures, with mechanisms for regulating activity (Piaget, in Bringuier, 1980, p.3). Piaget views intelligence as a process of adaption to the environment, with people developing increasingly complex levels of thinking in predictable stages; each stage having its own cognitive structure (schema). A schema, then, represents the organisation of reality in a particular way. As individuals add to their experiences, they develop new schemas - a means of adapting more effectively to the environment through assimilation and accommodation. Assimilation, according to Piaget, is the process of incorporating aspects of the world into cognitive structures, while accommodation is the process of modifying existing structures to incorporate new information. Finally individuals will possess the most advanced forms of thought where they are able to reason and think using hypotheses (Bell-Gredler, 1986, pp.191-200).

Intelligence then, according to Piaget, is an ongoing and changing process, rather than a fixed trait that can be measured quantitatively (as in traditional views of intelligence) and learning is a specific process within intelligence. Hence learning and intelligence, according to Piaget, must always be active

and dynamic as it seeks explanations and understandings in order to construct itself and function effectively. Therefore he views knowledge, not as a separate entity in the environment, but the on-going interaction of the individual and the environment. The growth of intelligence, is therefore dependent on the construction of new structures from prior structures. The factors which influence cognitive growth include the physical and social environment, maturation and the individual's self-regulation process (Bell-Greder,1986, p. 196 - 197).

There appear to be four major factors influencing cognitive development. All are considered necessary and are all interacting - equilibrium, maturation, activity and social interaction (Piaget in Bell-Gredler, 1986, p. 198). Equilibrium, according to Piaget is the learner's self-regulatory and self-correcting processes that function continually throughout development. Maturation through biological changes, argues Piaget, allows for development. However development proceeds at different rates, depending on the nature of the contact with the environment and the learner's own activity. The learner's activity is the process of acting on the environment by observing, exploring ideas or actively thinking about issues. Accelerating or retarding the development of cognitive structures is the role of social interaction - learning from others is considered an important role of education.

The major processes operating in the construction of knowledge, as seen by Piaget (1977a, p.3) are assimilation and accommodation regulated by the need for equilibrium. As well, Piaget (1980) has described the construction of knowledge according to the types of knowledge experiences in which the learner engages. These are physical experience and logico-mathematical experience. Physical experience, or exogenous knowledge (external to the learner) is developed, according to Piaget, through the abstraction of the physical characteristics of objects. On the other hand, logico-mathematical

experience, also referred to as endogenous knowledge by Piaget, is developed through the organisation of the learner's thought processes. The result of this process is the construction of new structures from prior structures - action schemes, concrete and formal operations.

Piaget (1950) theorised that thinking competence evolves through stages and suggests certain competencies and skills emerge at each stage. These can be identified through qualitative differences in modes of reasoning from infancy to adulthood. Development was seen in terms of the individuals progress from one level of mental development or knowledge to a higher level. Each stage is characterised by a particular type of operation, ie. the cognitive structure that governs logical reasoning (Piaget, 1970a, 1970b). He identified four fixed, age - related stages, the sensorimotor, preoperational, concrete operational, and formal operational stages. Each one `extends the proceeding period, reconstructs it on a new level and later surpasses it to an even greater degree' (Piaget & Inhelder, 1969, p.152). Piaget argued that all people pass through the same stages, but children may not function at the same level for all subjects.

The first or lowest stage, known as the Sensori - Motor stage (approximately 0 -2 years) sees development as based on information from the senses of the body, resulting in the development of action schemas. These simple structures contained knowledge of discrete personal experiences which are not linked together into coherent systems. In the second stage, or Pre - Operational stage (approximately 2 - 7 years) the child begins to master `operations', using mental rather than physical activity, and the beginnings of logical thought appear. The child becomes capable of symbolism with the development of six symbolic functions - imitation, play, drawing, imagery, memory and language. Piaget divided this stage into two sub-stages called `preconceptual' and `intuitive'. Piaget proposed that during the preconceptual

stage, children were capable of primitive representational processes he called preconcepts. A preconcept expressed only a single relationship between one symbol and the object or event it stood for. The limited meanings children have of first words reflects this. During the intuitive period there was an advance in representation. Though symbols were still not co-ordinated into a hierarchical system, they did consist of successive images. In the Concrete Operational stage (approximately 7 - 11 years) children can think logically when their experiences are linked to concrete objects or ideas, rather than to abstract concepts. Knowledge becomes integrated into systems and concepts, including conservation, transitivity, seriation and classification are developed. The child's thought becomes more flexible and the child is able to consider both states and transformations. The final and highest level of thinking is the Formal Operational stage (approximately 11 years and on) in which the child can think in abstract terms, ie. they can reason from the hypothetical situation to the concrete and solve problems by systematically exploring all possibilities. In this stage higher level thought and integrated systems of knowledge are constructed.

Another significant contribution to understanding the ways children learn has been made by the cognitive theorist, Bruner. Like Piaget, he sees knowledge as a process, not a product. He supports the existence of distinct stages of cognitive development, but claims they are not necessarily in a definite sequence. He offers a cognitive approach to curriculum development.

Bruner defines learning, or cognitive growth as `the development of internal systems of representation to deal with information, and the application of these systems to new information' (Brady, 1985, p.104). Bruner describes a knowledgeable person as one who is a problem solver; one who interacts with the environment in testing hypotheses and developing generalisations.

Bruner identifies three systems of processing information which, he claims, people use to construct their view of reality (Brady, 1985). The enactive stage is one in which knowledge is represented in actions, ie. children learn by doing things or observing others. The iconic stage is one in which children think pictorially or in images. The symbolic stage is one in which knowledge is represented by the use of words and other symbols to describe an experience. Children at this stage are able to think about objects that are not necessarily present and can hypothesise.

According to Bruner, language plays a major role in the acquisition of these three stages. Language is the tool by which students abstract understandings and communicate ideas. Thought, Bruner claims, is `internalised language' (Brady, 1985). In order to develop complex learning, using higher order thinking, Bruner highlights the importance of students understanding the `structure ' of the subject, eg. in reading. The ways in which concepts are organised need to be identified so that children can acquire a mastery of skills to master their understanding of those concepts. As he says, to be `ready' to learn a given skill, is precisely to be already equipped with other prerequisite skills (Donaldson, 1978, p.101). If one wishes to solve a problem it is desirable to register those features which are relevant to the solution. In finding the best ways to represent these features, eg. ways to make them easy to understand and to manage in the mind, then the child may achieve a more efficient representation of the problem. `Mastery of skills', according to Bruner `leads to a mastery of more powerful ones' (Bruner, 1966, p.35). `There are tools of the mind as well as tools of the hand, and in either case the development of a powerful new tool brings with it the possibility of leaving old limitations behind' (Donaldson,1978, p.85).

Werner (1957, 1978), another developmental theorist, cuts across Piaget's stages with his orthogenic principle which describes the processes which

characterise all development. According to Werner, development is regulated by

> an orthogenic principle which states that wherever development occurs it proceeds from a state of relative globality and lacks differentiation, articulation and hierarchical integration.
>
> Werner, 1978, pp108 - 109.

All development, then, appears to involve processes such as differentiation, re-integration and de-differentiation of experience, moving both vertically and horizontally in a complex organisation of patterns; this includes thinking and results in representational competence.

Sigel (1984) uses both these theories (Piaget's and Werner's) in his attempt to explain the development of thinking. According to Sigel, this involves both horizontal processes - differentiating groups, and vertical ones - structuring hierarchies. Sigel sees Piaget's notions of stages and Werner's orthogenic principles as complementary in children's thinking and problem-solving skills. Piaget describes the logical operations children use at differing levels of development while Werner's orthogenic principle describes the process that children use in organising knowledge, eg. in classifying a group of items, children might be grouping on the basis of single or multiple attributes, thus evidencing different levels of logical thought. Irrespective of the logical strategy being employed, they are still differentiating attributes and integrating them.

In what ways do the theories of Piaget, Bruner and Werner impact on children's learning and thinking as they relate to classroom teaching practices? The role of education, according to Piaget and Werner, is to support the on - going research of the child, enabling the development of a clear conceptual framework and higher order thinking. Experimenting with real objects through active manipulation and the interaction of peers, combined

with insightful questioning by the teacher, Piaget argues, assists the child in constructing both physical and logico - mathematical knowledge. The curriculum needs to provide opportunities for children to interact with the physical world in a variety of ways, developing answers through interaction with peers.

Learning, Bruner suggests, is facilitated by the inclusion and combination of concrete, pictorial and symbolic methods of representing materials. Bruner therefore argues that cognitive development can be accelerated at any level if appropriate exploratory material is presented to the student and that `any subject can be taught effectively in some intellectually honest form to any child at any stage of development' (Bruner, 1977, p.33). More complex skills may be learned if they are preceded by the learning of more basic ones. The goal of education should therefore promote intellectual development through curriculums that foster the development of problem-solving skills through the process of inquiry and discovery. These skills include predicting, explaining, hypothesising, concept formation and interpretation of data.

Bruner's theories apply to all subject areas, including moral reasoning and is language based. What are the areas in which Piaget's theories can be applied? Is thinking confined to logical operations? Piaget deals with logical thinking as it applies mainly to maths and science. What is the relationship between logical thinking and reading and writing? It appears he does not consider language and thought as part of the same system. Consequent studies have challenged Piaget's stages of logical thinking. Margaret Donaldson in Children' Minds (1978) suggests even very young children are capable of logical reasoning. She claims it is Piaget's methods of investigation that don't allow a more realistic picture of a child's mind. Rather than failing to reason, she argues, the child fails to understand. Does the child really understand the requirements of the task at hand? Is the language

of the experimenter familiar to the child? How different is spoken language to written language so often used by adults? Donaldson argues that a child can only 'decentre' his/her thinking if the language used is in the context of their own experience. The differences in children's abilities to reason then, according to Donaldson, is a difference in their readiness to treat language in some degree of abstraction from context.

Over recent years the limitations of Piagetian theories have been documented. There is still general agreement that learning is making meaning out of experience rather than just receiving knowledge, and that children acquire the processes of thought gradually, with recognisable differences between the kinds of thinking occurring at different stages of development. Recently, however, developmental psychologists have concluded that the way children pass through individual stages are much more continuous and gradual than Piaget suggested. Rather than the Piagetian notion of superseding a stage once it is passed through, it is currently argued that all modes of thinking at various developmental stages are equally important and continue to co-exist with mental growth. Cognitive skills increase with children's opportunities to learn more propositional and procedural knowledge, resulting in a piggy-back effect; new skills grow out of modifications to old ones. A Neo-Piagetian approach suggests development between and within stages may be related to changes in information - processing capacity (Biggs & Collis, 1982).

It appears that the development of thinking skills may involve qualitative as well as quantitative changes. Biggs and Collis (1991) have recently attempted to explain the variations seen in children's thinking in terms of five modes of thinking. These modes of thinking are defined as characteristic ways of thinking and representing content and develop from birth through the interaction with the environment, including the development of language.

They are the Sensori-motor mode in which meaning is constructed from experience through the senses or through movement. The very young child knows `how to do' but hasn't developed the language to explain what or how they are doing it. In the next or Ikonic mode of operating, children create images and use linguistic descriptors (direct symbolism) to represent their experience as they interact with the environment. Children begin to construct intuitive knowledge - knowledge made from meaning without the use of conventional logic, which continues to grow in power and complexity beyond childhood. The Concrete symbolic mode of thinking is characterised by the use of written, second-order symbol systems, such as written language, mathematical symbols and musical notation. Children are now able to construct declarative knowledge, declaring and describing what they know. In the next or Formal mode of thinking children are able to construct and manipulate theoretical knowledge by using abstract reasoning to hypothesise about alternate ways of ordering the world. The final and most advanced mode, Post-formal signifies the learner's ability to question conventional bounds of theory and establish new ones.

Current theorists suggest that all these modes of thinking are equally valuable and as each mode develops, they believe, its predecessors continue to co-exist with it. This co-existence greatly enhances `modal repertoire' - the ways in which a learner thinks and represents content. It also increases the variety of strategies that the learner has at his or her disposal for problem-solving. It has been suggested that children who exhibit fluid and flexible thinking have all these modes well-developed and are able to move effortlessly between them. In order to encourage optimum learning, it would appear that teachers need to cultivate each of these modes in students, so that they may have access to them throughout life.

It is also generally agreed by current theorists that as children's thinking becomes more efficient and flexible their knowledge base increases. They appear to have increased access to knowledge. They appear to have more efficient use of cognitive strategies and an increased capacity to process information.

Teaching practices in Tasmanian schools have reflected the influence of Piaget and his cognitive-developmental theory since the 1960s. The Committee responsible for the Three to Eight Report, 1968, highlighted the views of Piaget as they influenced the relationship between the individual, the teacher and the environment, as well as self-discovery and the gradual understanding of the world. Hence the Report recommended programming for continuity of development, as well as activity-based teaching methods. Hence curriculums came to reflect continuous and sequential development as well as active learning with the environment.

This was further developed following the TEND Report (1978), Tasmanian Education: Next Decade Committee, which recommended that individual learning could be facilitated through the development of more relevant school-based curriculum programs. Children's needs and interests could be more effectively met. The individual child was all important as they developed physically, intellectually, socially, and emotionally.

The need for meaningful learning was also the basis of the recommendations of the Committee on Primary Education, 1977, set up to investigate the needs of the primary school child. They claimed that the teaching of basic skills was a part of a child's education, but not the purpose. Rather, education was to be seen as 'preparation for a satisfying and useful life'. Teachers were to be seen not as givers of knowledge, but as creators and providers of experience, co-operating with the child in a variety of activities whose knowledge of each

child's personality allowed for the provision of meaningful experiences. Children were no longer to be passive receivers of knowledge, but active constructors of knowledge. At this time, the processes involved in learning, rather than the product were taking prominence, with programs developed along process lines. No longer were the learning of basic skills considered a priority. Rather, education needed `to provide the basis upon which skills could be developed, rather than teaching the skills themselves' (p.13). According to the Role of School in Society Report, 1967, `we live in a society of change, ... changes are constantly accelerating so that the future becomes increasingly unpredictable' (p.11).

2.5 Constructivist Theories of Learning

Cognitive/Developmental theories of learning have been further modified and refined by educational psychologists, as they develop new understandings about how people think, develop and learn. These are generally based on the Constructivist Model. This model sees knowledge as being actively constructed by the individual as he/she makes meaning from their experiential world. Learning is an adaptive process as learners make connections between new information and the learner's existing network of knowledge (Department of Education and Arts, Tasmania, 1991).

The Constructivist Model argues that learning is a process in which students' minds are actively engaged in integrating new information with existing knowledge, in which personal understandings are being constantly revised. The learner, then, is a constructor of knowledge, and coming to know is the result of their interacting with the surrounding environment. Knowledge, then, is assumed to be an end product. The child's mind naturally and actively perceives and constructs relationships and regularities(meaning) about surrounding objects, events and people, and in doing so new knowledge is

integrated with previous experience, forming an ever-increasing knowledge base and an increasing complexity or sophistication of concepts (Copple & others, 1984).

The child develops cognitively by recognising and resolving discrepancies, that is, inconsistencies between what is expected and what actually occurs in the environment (Copple et al., 1984; Sigel & Cocking, 1977). These incongruities usually generate tension, which in turn generates activity to resolve the tension. This activity associated with problem solving and questioning thus creates the opportunity for new learning. The perception of a discrepancy is limited by the individuals current expectations or knowledge, hence a child needs to be at a sufficiently advanced developmental stage for the detection of a discrepancy to occur.

Constructions of knowledge are organised by the learner into conceptual representations. These concepts are transformed mentally into some symbolic form, maybe as a picture, word, design or kinaesthetic sense. These internal representations (the products of constructs) are communicated through external representations, eg. words, photographics, gestures, maps etc., each of which presents some inner thought or wish (Sigel,1978). The formation of representational competence or the ability to represent according to Copple et al., 1984) is guided by three general principles. Firstly, human beings understand the world through representations of it. Secondly representational competence develops in an orderly sequence (Piaget, 1951, Werner, 1957, & 1978) and thirdly, representational competence develops fully only in response to interactions with appropriate physical and social environments.

Teachers then, according to constructivist theory, need to provide opportunities where children are continually challenging their current

understandings, and developing representational competence in a variety of ways through interactions with each other and the environment.

In the document, Our Children: The Future, Teaching and Learning (OCTF), 1991, developed to `guide high-quality learning programs' in primary schools in Tasmania, constructivist learning is seen as central to children's development and meaningful learning. The Report claims that the social and cultural purposes of schooling are now needing to be balanced with an emphasis on intellectual development. The document also emphasises the important role of the teacher in intervening `to highlight the new knowledge and to challenge its co-existence with the old' (p.8).

The document, OCTF, 1991, identifies five sets of capabilities or competences that children need to be continually developing and using. These are personal, linguistic, rational, creative and kinaesthetic capabilities. It claims that these are the broad skills that enable people to learn and continue to learn throughout their life.

2.6 Socio-constructivist Theories of Learning

The most recent theories of learning stress the importance of the socio-cultural context as well as cognitive processes in learning. Dialogue between educators, psychologists, sociologists, psycholinguists, and anthropologists, among them, Rogoff, Reggio Emilia, Bruner, and Wertsch, have resulted in a socio-constructivist theory based on these beliefs.

Central to this theory is the image of children as `powerful, rich, competent and strong' according to the Reggio Emilia view (New & Mallory,1994, p.188). All children are to be respected and valued in their own right, regardless of the nature or the cause of their differences. They therefore have the right and capacity to participate in decisions about their own learning. They are viewed

as `co-protagonists' with teachers, parents and peers in the construction of both the content and context of the curriculum. All children are seen as learners, operating in a community of learners, not as individuals with varying degrees of abilities or disabilities, deficiencies or differences. All children, it is argued, are capable of making their own choices, knowing and expressing their own needs and desires, and hence able to participate in the construction of their own education. This is in contrast to traditional views of children, portrayed as passive and compliant, without their own ideas and capacities. This view of dependency in children has been associated with custodial approaches to care and education.

As well, New (1994) argues that the image of the `whole child', that is, one whose intellectual, social, emotional, affective and physical dimensions are inextricably linked, can no longer remain focused on the individual child in isolation. Rather our image of the child needs to include recognition of that child's membership within a particular socio-cultural context, represented by family, school and community. School settings therefore should reflect the diversity of socio-cultural backgrounds in order to adequately respond to the needs and potentials of a diversity of children; being inclusive, rather than exclusive.

Socio-constructivism acknowledges this diversity as intrinsic to both the context and sequence of children's development. This theory is based on the premise that mental activity is inextricably bound to learners' varying social contexts. Acknowledged also is the theoretical need to understand and accommodate diversity within children's development.

Views of knowledge and learning are therefore linked to its social context. Knowledge is not viewed as an abstract construct, but focuses on `the information that is used in an individual's life in order to conduct the

necessary daily routines and social exchanges that characterise and define the setting' (New & Mallory, 1994, p.191). Emphasised also, especially by cultural psychologists, is the mediating role of the cultural context in interpretations of reality. The construction of knowledge, according to Rogoff, takes place through the individual's apprenticeship to the rituals and routines, the responsibilities and the possibilities, found within a family, a classroom and a society (New & Mallory, 1994, p.191). Children, then, are seen as apprentices as they actively observe, engage with and learn from their peers and more skilled members of their society. School settings, then, can provide opportunities for apprenticeship to the socio-cultural context, since a range of interests, abilities and understandings are represented by the children and adults within.

The socio-cultural construction of knowledge acknowledges that children not only learn from the cultural context within which they are embedded, but they too, according to Reggio Emilia, contribute to the development, the maintenance, and the growth of that culture (New & Mallory, 1994, p.191). Schools, whose members include children, parents and teachers, are seen as creating their own sub-cultures. Children are seen as major contributors to that culture. In Reggio Emilia the relationship between children and their culture is regarded as dynamic, transactional, and enduring.

Not only are the social and cultural contexts in which children live important, but also the social exchanges which take place within those settings. For, according to Rogoff, it is these interactions among children and with adults that provide guidance, support, and motivation to persist in the gaining of knowledge and skills (New & Mallory, 1994, p.192). Interactions can vary in kind, frequency and quality, with conflict often being a major part. Reggio Emilia educators see diversity in those exchanges as a significant way of drawing children's attention to multiple view points. They claim it is the

presence of multiple points of view that contribute to `meaningful and constructive conflict', and that knowledge needs to be represented in a way that elicits someone else's response in order for meaningful learning to take place.

This social construction of knowledge therefore encourages collective rather than individual intelligence. It is the theories that are constructed by the group, it is argued, that are to be valued. As well, all children don't need to go through the same steps or experiences to benefit from an event or activity. It is through this collective learning, the Reggio Emilia teachers claim, that the Vygotsky's zone of proximal development is made apparent and more complex learning able to take place. For being with `more capable others' in a supported role, a child comes to understand problems that are marginally beyond his or her present abilities. The role of the teacher, then, is to create situations that complicate children's thinking and then encourage children to work together in their exploration of possibilities.

Important also in a socio-constructivist view of learning is the active participation of the individual in his own learning and development. Learners take on new understandings as a result of participating within a group context. According to the Reggio Emilia view, children, teachers and materials become co-protagonists in this process. As a result they begin to behave differently and contribute to the group as a result of their new understandings. Knowledge is therefore seen as dynamic, rather than a static collection of stored representations, memories and plans. The acquisition of skills and understandings are seen as an active process which varies from child to child. Learning therefore is a process of change in children as a result of participating in a share event within a larger context, not just a matter of children learning something new. It is through active learning, the socio-

constructivists argue, that children become competent, powerful and resourceful learners.

The implications of the socio-constructivist view of learning and development for teaching can be observed in the development of inclusive practices. Inclusion in education relates to the acceptance of a broad range of developmental abilities and other individual differences, including cultural differences. These differences are considered as positive resources in the classroom (New & Mallory, 1994). What is required, then, are learning communities in which all children can be included and participate as valued members of the community, regardless of gender, class, race, physical or intellectual capability or religion. These communities consist of sets of routines, rites, and rituals that assist individuals to participate, contribute and belong to a larger group, without disadvantaging any of its members. Children's diverse cultural backgrounds, abilities and interests are seen as important components in problem-solving, and assisting collectively with more complex learning. By working in small groups, using language, children are able to co-construct their understandings, form hypotheses and help support each other in attaining common goals. Through building upon children's interests and linking content to context, inclusive curriculums are likely to be fostered.

Children become engaged in real problem-solving by bringing their own interests and questions into the classroom. Social and cognitive conflict within a context are made more authentic by the diverse backgrounds, abilities and interests of the children. In finding solutions or generating new hypotheses, children are encouraged to be risk-takers and see errors as part of the problem-solving process. There is a need for a variety of learning modes to be catered for, eg. through language, concrete models or drawings, or kinaesthetic modes.

Inclusive curriculums (New & Mallory, 1994) provide opportunities for feedback and assessment in emotionally supportive contexts. Children are more able to understand the consequences of their actions and to monitor their own behaviour. Assessment and curriculum planning are based on careful observations and documentation by the teacher, as children problem-solve, play and talk with each other. In regarding children as powerful, competent learners, teachers convey respect and confidence in each child's ability to succeed, offering praise for genuine effort, or honest criticism where due.

The role of the teacher needs to be that of collaborative researcher in inclusive classroom communities. Teachers need to put themselves in the children's `shoes', especially where children have `doubts' (New & Mallory, 1994). Teachers are then in a position to question and improve their own understanding of the child's abilities and behaviours. In so doing, teachers are able to be supportive in assisting with the child's new learnings. As a protagonist, teachers help the children to see the value of being challenged, of making interesting mistakes and having dialectical relationships with each other. Parents, too, need to be seen as partners in their children's education. Being welcome members of the school and being part of the ongoing debate as to how best to serve the interests of all children and the wider community support inclusion.

In response to socio-constructivist views of learning, the Department of Education and the Arts, Tasmania, released The Framework for Curriculum Provision, K-12 (1993), to guide teachers' programming. In it the importance of individuals developing personal, linguistic, rational, creative, and kinaesthetic capabilities by drawing on their knowledge and experience developed within a social context is presented. When combined with the eight learning areas considered to represent a cross-section of Australian

culture, identified by the Australian Education Council, (Mathematics, Science, Technology, Health and Physical Education, Studies of Society and Environment, Languages other than English, The Arts, and English), a curriculum framework for teaching is provided. It is considered that this framework ensures that all students have opportunities to achieve outcomes as outlined in the national profiles, encouraging children to be powerful and competent, and able to work together to reach worthwhile goals, hence adequately preparing children for the challenges of living and working in the twenty-first century, and becoming responsible members of society.

Views of children's learning, thinking and development have changed significantly over time. Most recent theories are based upon combinations of some major features of previous theories as well as modifications based on the changing views of knowledge and its construction, intelligence, images of children and the ways they develop meaningful learning, and the role of education. It appears that not only are cognitive processes important in children's thinking and learning, but the socio-cultural context as well. Both appear to be powerfully and inextricably linked in the development of lifelong learning and thinking skills. Teaching practices which reflect the importance of these factors are based on a socio-constructivist perspective of learning and development.

There is evidence of many of the afore-mentioned models operating in contemporary classrooms today. For example, in learning and practicing specific spelling skills or ball skills in physical education, the behavioural model might be used effectively. Aspects of the transaction model may be applied where it is appropriate for students to be free to explore and discover, or to select or direct their own learning. The interaction model may be applied to help understand the views of others when trying to make a stance on a controversial issue, while the cognitive developmental and constructivist

models might be used to test thinking by questioning students in relation to problems. What seems paramount is that teachers choose teaching and learning strategies, based on particular models, which are within the overall context of the socio-constructivist perspective of learning.

In summary, it seems that in order to promote successful learning in all children, knowledge needs to be actively constructed in a socio-cultural context. The diversity represented in individual differences, based on background and experience, positively contributes to social exchange. These commonly take the form of questioning, conflict resolution, problem-solving and decision-making. Communication through language, then, appears to be an essential part. The following chapter examines evidence to suggest that control of one's thinking seems inextricably linked to control of one's language, in particular, one's oral language. It appears this process is facilitated through social exchange.

All children are viewed as powerful and competent and, at the same time, valued as members of a community of learners, while teachers are seen as co-learners who facilitate this kind of learning. For it seems that it is this process which effectively promotes the expansion of knowledge, and the refinement of ideas. This process also forms the basis of skills necessary for individuals to become independent and lifelong learners; who come to see themselves as worthwhile and responsible members of society and contributing to its future good.

3. THE ROLE OF LANGUAGE IN COGNITIVE DEVELOPMENT

Research evidence (Donaldson, 1978; Clay, 1991; Coles, 1994) suggests that language appears to be both a highly significant and integral part of cognitive development. For it seems that language is the means by which individuals make sense of the world. However there are differing views about the ways meaning is constructed through the use of language. Traditional views of language acquisition (Donaldson, 1978) suggest that meaning is constructed external to the learner through the medium of language, with words being learnt in isolation. More recent views (Coles, 1994) suggest making meaning is a continuous internal process in which the individual, from a very early age, uses their own language and their interactions with the environment to formulate ideas about the world and make internal representations in their minds. Control of one's own thinking seems inextricably linked to control of one's language, in particular one's oral language (Donaldson, 1978; Clay, 1991). This appears to be facilitated through social exchange. Control seems also to be linked with self-awareness. Learning to read may even influence a child's ability to control his thinking. Traditionally language has been treated as a separate subject in schools, but more recently, it has been acknowledged that language is an integral part of all areas of learning. It seems that young children have already developed quite sophisticated reasoning powers before they come to school, through their use of oral language, particularly through conversation (Hughes & Tizard, 1984). However this seems to be masked by the demands placed

on them in their early school years as they make the transition to written communication. As well, the nature of classroom talk in many contemporary settings seems not to be conducive to optimising the development of language and thinking (Coles, 1994). Therefore, attempts which increase our understandings of the relationships between language and thinking in order to promote more advanced thinking would therefore seem invaluable in informing our teaching practices.

Well before a young child comes to school, he/she has learned to use language in quite a sophisticated manner to help him make sense of or to get meaning from the world around him. He has already learned to negotiate and communicate his messages, to develop his understandings of the world and its regularities and to test these with adults. This is the everyday existence of young children (Wells, 1986; Hughes & Tizard, 1984). The conversations young children have with adults appear to be an important part of this process (Clay, 1991). Through his interaction with people and things, the child is able to make language match with what he experiences in the environment.

The child develops models of his own about what goes on in the world. He can carry out actions, or talk about carrying these out. He can make links and predictions about what will happen if . . . . The child is actively seeking out, using logical reasoning, and finding regularities in the experience he has with the world and even work out what some of the invariances might be. He is able to act on his knowledge even though he cannot always describe what it is he knows. It would seem then that from a very early age, children use language to advance their knowledge and understanding of their world.

This is in contrast to past ideas which suggested language developed in mechanical ways as isolated associations between words and things, and that `meaning' was an outcome of the conditioning process by which the associations were established (Donaldson, 1978, p.37). Hence language was traditionally taught as a separate subject, and words taught in isolation, with teachers dominating classroom talk.

More recent ideas (Donaldson, 1978; Coles, 1994) suggest meaning is made by one's ability to make sense of things and to make sense of what people do, which includes what people say. If we accept this view, it is the child's ability to interpret situations which makes it possible for him, through active processes of hypothesis-testing and inference, to arrive at a knowledge of language (Donaldson, 1978, p.38). If this is so, then language is intricately linked with the development of the mind, and is one component in a complex series of interactions between a wide variety of learning experiences. Therefore language is seen as significant in all areas of the school curriculum, with learners requiring ample opportunity for social interaction with adults and peers in order to develop more advanced thinking.

According to Clay (1991), it is the conversations that young children have with adults that contribute significantly to the development of language, thus facilitating continuing development towards mature language. In fact, for the first five years the child's language growth is entirely dependent on what people say to him - on how much they speak to him, about what things, in what dialect or language or in what manner (Clay, 1991, p.70). It is the special attention given by a parent or a caregiver who is with a young child most of the time that enables the `private' language of a two to three year old to develop further. As they talk together, the child `revises and refines his language, experimenting, making funny errors but gaining all the while in

control over the expressiveness and the complexity of the language'(Clay,1991, p.69). Through conversations with adults children come to know that they have something worthwhile to communicate. If a child's language gets attention only when in error, he may come to feel his speech is defective. Rather, Clay (1991) argues that it is natural for the child to make errors as they attempt to make use of more complex, successive stages of language, through testing in new situations. As a result, children become competent in the language of their caregivers and playmates; in the dialect of a particular group (Clay,1991,p.71).

Therefore, in order to foster children's language development, opportunities need to be created for children to talk, and then for adults to talk with them (not at them), in genuine conversations. This appears to be significant in a child's language development, not just in pre-school years, but throughout their years at school.

It appears therefore that teachers of children in early childhood education, especially, should continue this first language that children use so frequently, as their making of meaning appears dependent on this. Rather, according to Clay (1991, p.71), teachers should try to add to their speech a dialect for standard English that would be used in some oral situations and found in the world of books. It appears that this can best be achieved by encouraging children in a variety of conversations, therefore adding to his range of language, and increasing his control over it.

Vygotsky (1962) and Donaldson (1978), also stress the importance of using conversational speech to promote the making of meaning through reasoning. They argue that the gap between a young child's and an adult's ability to reason deductively may be less than many people have claimed. Donaldson

and Vygotsky argue that young children may not be aware of language as a distinct system and this could account for their inability to perform certain reasoning tasks, as in the Piagetian experiments, due to an unfamiliarity with the meaning of language. Rather than `a failure to reason', they argue, it is more likely `a failure to understand' (Donaldson, 1978, pp.40-50). They argue that children are unable to decentre their thinking if the language used is outside their sphere of experience or context. They draw attention to the difficulties young children have when dealing with abstract problems when the conversational support of others around them is removed. They are unable to make a meaningful connection, or use disembedded thought in order to facilitate the use of language in some degree of abstraction from context, allowing children to become aware of language as a distinct system.

This apparent failure of children to understand appears to be related to the particular theory of language that is acknowledged by some teachers. In line with more traditional views of language development, this theory views language as a medium through which thought is conveyed, with meaning being `out there' (Coles, 1994, p.11). Evidence of this interpretation comes in many learning experiences in the classroom; one being the form of discourse controlled by the teacher's questions which often demand quick, short, factual answers, leaving little time for children to respond, elaborate or reason out loud. Without this opportunity, some children appear unable to express their ideas and formulate their thoughts. Since language and thinking are fused in verbal reasoning, some children lacking expertise in the process of creating coherent, `disembedded' accounts of what they know and understand, may appear intellectually incompetent, when rather it is a problem of making sense to others. Teaching practices based on this theory of language appear less likely to contribute to the development of language and thinking than those that view language and thinking as synonymous.

For in this latter view, meaning comes into being through language. In `learning how to mean', (Halliday, 1978) children not only advance their linguistic abilities, but also discover how to plan, evaluate and monitor their own intellectual activities. For this to be so, the nature and quality of classroom discourse plays a vital role in developing a child's ability to learn and to reason analytically. Questioning by both students and teachers in the class appears to be a powerful way to realise thought which is yet unthought; which is only potential. Having a thought or idea and then expressing these in language would seem to be paramount in the development of mental activities. Together, the expressing of thought through language contribute to a more sophisticated form of intellectual functioning (Coles, 1994, p.11). Contemporary theories of learning and development, in particular the socio-constructivist view, emphasis the importance of the interaction of individuals with each other in order to refine and develop new understandings and ideas.

Children's increasing control over language and thinking also appears dependent on their consciousness of it. Control, it is argued, is `at the heart of capacity for disembedded thinking, . . .sticking to the problem and refusing to be diverted by knowledge, by beliefs or by perceptions which have nothing to do with it' (Donaldson, 1978, pp.93-94). What appears to be important is the child's own awareness of his thought processes. For she quotes Vygotsky as saying: ` . . . . control of a function is the counterpart of one's consciousness of it'. If a child is going to control and direct his own thinking, then he must become conscious of it. Self-awareness, then, seems to be an important factor in the development of one's thinking. According to Piaget (1977b) as related by Donaldson (1978 ,p.94), it develops when we pause mid-way through a task. Instead of just acting, we stop to consider possibilities for acting further. It is claimed we heighten our awareness of

what is actual by considering what is possible. Self-talk and conversations with others would seem an integral part of this process. The choice to take a particular course over another, then, appears central to the development of thinking (Donaldson, 1978, p.94).

Further possible links between increased control of language and thinking have been made by Donaldson (1978), who suggests that the process of learning to read may have a significant contribution to make in enabling the child to choose to direct their thinking in one way rather than another. The child who is learning to read is likely to be in a situation that is likely to encourage possibilities in relation to one important act of thought : the apprehension of meaning. The lasting character of print means there is time to stop and think and consider possibilities.

> Those very features of the written word which encourages awareness of language may also encourage awareness of one's own thinking and be relevant to the development of intellectual self-control, with incalculable consequences for the development of the kinds of thinking which are characteristic of logic, mathematics and the sciences.
>
> Donaldson,1978, p.95

A further significance of learning to read on the development of the mind comes in the complexities involved with learning to read. In order for a child to extract meaning they need to choose from many possibilities. A child who masters these processes is seen as developing intellectually. For according to Donaldson, the mastery of complex reading skills contributes significantly to the growth of the mind. Hence it could be seen that the process of becoming literate has marked effects on the growth of the mind.

Teaching practices which encourage and allow children time for reflective awareness seem therefore to be significant in increasing children's control over their thinking. This appears to be enhanced through social interaction.

As well, in learning to master literary forms, children will best grapple with meaning if they are first allowed to deal with familiar cadences of the spoken tongue, and gradually be introduced to other literacy forms as the child's confidence and competence grows. Making children `ready' to learn means finding ways of representing features in problem solving situations so that they are more manageable in the mind. Using a familiar conversational language appears to support this learning process in all subject areas.

Conversation therefore seems to play an important role in the development of higher-order thinking. However indications are that the current status of conversation in classrooms vary considerably. Previous school reports have referred to states of talking too much. Yet well-focused conversations enable the development of many kinds of thinking, eg. critical thinking. As well, much can be learned about children's thinking by analysing their conversations. Contemporary theories of knowing and being emphasise the interaction of individuals with each other and hence the importance of language, including talking. Conversation, it is claimed, is essential for intellectual growth - helping the child to make sense of her present experiences by relating them to past experiences, as well as to her existing framework of knowledge.

The process by which children make abstractions from meaningful discourse that enable them to become independent and reflective thinkers is complex (Vygotsky, 1978; Rogoff,1990). Even so, researchers (McTear, 1981; Hughes & Tizard, 1984; Siegel,1991; Dunn,1992; Haight & Miller,1992; Scholnick & Wing, 1992) have evidence through analysis of discourse to suggest that quite young children are capable of abstract reasoning. It has been suggested that critical thinking can become a normal part of classroom life by encouraging the use of certain kinds of conversation in class communities (Coles, 1994). However researchers alert us to the potential for restricting or

even inhibiting cognitive growth through the specific nature of classroom talk. It is through an understanding of these issues and assertions that teaching practices are likely to be better informed.

Recent socio-constructivist theories of knowing tend to emphasise the social nature of the construction of knowledge: students learn by `putting it into words' and articulating ways of knowing by building representations of various symbolic systems. The view is emerging that curriculums should provide a conversational space or domain within which students can engage new subject matter. This is achieved through classroom talk where questions are asked, ideas generated, shared and challenged and deeper understandings of concepts formed.

It has often been maintained that young children's knowledge is limited to perceptual appearances; in this pre-operational stage of development there are profound conceptual limitations in that they have limited understanding of numerical and causal relations and are incapable of insight into the minds of others. Their apparent inability to perform well on traditional developmental measures has had a major impact on educational programs, especially in regard to their readiness for instruction, especially in maths and science (Siegel, 1991). Children's apparent limitations on these tasks can possibly be explained in terms of the language used in experiments. Children do not share an experimenter's purpose in questioning and how his or her words are intended, often finding them irrelevant, or ambiguous. It gives little opportunity for the child to demonstrate the depth of their understanding. Siegel (1991), therefore proposes a different model of development whereby young children's abstract knowledge can be examined through attention to their conversational experience.

Evidence suggests that children already engage in reasoned thinking prior to school through conversations with both peers and parents. Before the age of six, children can formulate simple hypotheses, eg. `if we had a real one and your Daddy had a real one it would be good' (McTear, 1981). Children as young as three will ask for clarification of meaning (Garvey,1975). Four year olds will offer alternate suggestions if they do not agree with what their peers have said (Shields,1980). Even two year olds can make self-other comparisons (Haight & Miller, 1992). Studies also show the power of children's social understanding in real-life social interaction: their grasp of how to influence others, how to negotiate and resolve conflict, how to ally with and support others or share a pretend framework; topics on which children of this age would find answering questions responding to `tests' very difficult. Studies such as these, whilst considering the need to be cautious when making inferences about children's capabilities from natural discourse, make a powerful and convincing argument for the notable abilities that children show in conversation. This is in comparison with their apparent difficulties when asked to perform in more abstract terms in interview and test settings.

What issues do such discrepancies between children's capabilities in natural conversation and in interview test situations raise? Why is it that children demonstrate such abilities in discourse with familiar others? What are the developmental changes that enable an 8 year old and not a 3 year old to cope with questions in an abstract setting?

According to Dunn (1992), there are several possibilities relating to the abilities shown in the natural conversations of children. The collaboration with a more mature person, such as those which parent-child or sibling-child conversations involve, and the intellectual support that such collaboration provides, may be important, as has also been expressed by Clay (1991). It is

also supported by Vygotskyan theory and Scholnick and Wing's demonstration (1992) that `the origin of logic is collaborative' : children who have not yet reached the stage of making `if - then' arguments are able to process logically the frames that adults set up for them. Parents provide the initial premises, the prompts for inferences, and feedbacks to the children's attempts. The importance of this collaborative aspect is not then reflected in items of an individual child's speech, but at a discourse level; in logical discussions, and reasoned arguments. Findings by Haight and Miller (1992) in parent-child exchanges suggests dependence on others decreases with age.

Another significant factor could be the importance to children of conversations in which their emotional interests are directly involved. So many conversations of young children are focused on the child's self, in real life settings. Test settings in which an investigator defines the topic may well be less engaging. As well, children's familiarity with the setting and topic in their own conversations with others and their control over what's happening to them may also be a relevant consideration.

With regard to what it is that develops, that enables the 8 or 9 year old child to deal with abstract problems away from the support of the conversation with another, a focus on discourse highlights several developmental changes that may be significant. For instance, Eisenberg and Garvey (1981) noting that `by age 4, children have learned virtually all the strategies available to older children and adults' speculates that the developmental changes that follow involve an increase in the frequency and sophistication of reasoning, in the range of authorities referred to, in the use of delay and abstraction techniques and in metacognitive reflection on the rules involved. In fact metacognitive reflection was rare in early logical talk. It therefore appears that children's

ability to reflect on and discuss their knowledge of rules and strategies may contribute to metacognitive development in post pre-school years that are the key to children's successful performance on test and interview assessments of cognition. Another developmental change that may be significant is the decrease on the dependence of others and the development of the ability to reflect on self apart from others (Haight & Miller, 1992). Individual differences may arise due to powers of logic thought, sense of self, quality of relationships with parents and peers and understanding of social rules.

These, then, are some of the ways in which discourse in young children contributes to the development of abstract reasoning. But how can conversation be used to advantage in whole classroom situations? Conversation appears to be a major key in the curriculum as strong communities are created as we listen to what contribution each voice has to make. For educational purposes Lipman (1988) has pointed out that the behavioural matrix of thinking is talking, and the matrix of organised thinking ie. reasoning, is organised talking. Talk, then, can be the catalyst of cognitive and affective change. According to Coles (1994), by encouraging certain types of conversations in classrooms, critical thinking will become a normal part of classroom life. What do the discourse analysts tell us about the nature of current classroom talk and how might we modify this to encourage more critical thinking in classrooms?

A considerable body of work describing classroom talk, much done in the 1970s, suggests that much classroom talk has to do with keeping control and managing social relations than with pupil learning. A later work by Hughes and Tizard (1984) has shown how young children's natural enthusiasm for cooperative learning is suppressed in favour of the teaching priorities of the school system. Often children are encouraged to work on their own, and

considerable amounts of time are spent passively attending to teachers' talk. However, most teachers are aware that children need to talk. Nevertheless, `there is a shadow which falls between the idea of the value of collaborative talk and the reality of classroom practice' (Howe, 1988). There seems little recognition of what Alfred Whitehead asserted sixty years ago: `The habit of active thought, with freshness, can only be generated by adequate freedom'.

Children find it natural to collaborate through peer group discourse as they attempt to make meaning using language. However, they are less likely to do this when adults (teachers) are involved, since adults are perceived to be more knowledgable and thus children are less open to challenges, questions, suggestions etc. (Coles, 1994). Coles also reminds us that we are still very much influenced by traditional views of education which aimed at producing basic levels of literacy and numeracy. As Alexander (1984, p.62) explains, `The ability to use spoken language - to communicate, argue, reason, generate ideas, express and choose opinions and deepen understanding - was not only superfluous to the economic, occupational and political requirements of those who devised the system, but was potentially subversive of them'.

Even though teaching has become progressive, based on pupil-centred learning as promoted by Dewey (1956) and others (through project activities, small group work, merging two or more subject areas, more contact with the outside world, more freedom of movement in the class, and more flexible groupings), the dominant pattern of instruction is still teacher centred and the dominant mode of classroom organisation is teacher talk, even though progressive pedagogy recognises the need to cultivate independent and reflective thought in classrooms. Observations of classrooms over time suggest that although children are given some control over organisation and some opportunities to talk, there is room for much more of this.

What is needed, according to Lipman (1988) and recent educational policy in Australia, as proposed in The National Statements and Profiles for Australian Schools (1991-1994) and The Key Competences - For Work, Education and Life (1993), is a community of enquiry in which children act co-operatively in the search for understanding. According to Lipman, each person feels valued as part of the whole community and each member benefits from the ideas and experience of everyone else. There is an atmosphere of trust, mutual respect and a commitment to learn from each other. Thinking levels are extended as differences of opinion are expressed and considered as deeper understandings become apparent. This kind of dialogue requires reasoning: sizing up assumptions that underlie each utterance, drawing inferences, testing for consistency, learning to think independently by freely choosing one's own premise. This kind of discussion fosters critical thinking, which is based on the reasoning process.

By thinking together, this kind of enquiry has a `scaffolding' effect on the individual's cognitive processes. Classrooms where discussion and debate are commonly found better able individuals to formulate ideas and deepen understandings by relating current views and understandings with others in a supportive atmosphere. In adopting this teaching procedure of critical enquiry, the teacher's role as authority and judge gives way to the teacher as mediator of the discussion. This is in line with the Socratic approach of searching for truth through dialogue and debate. The teacher then becomes a co-enquirer with the students. The challenge for the teacher then is to accept the ever changing character of meaning (being examined from different perspectives), and at times uncertainty, when children are asked to think for themselves.

However, observations of current classroom practice indicate that it is the teachers rather than the children that ask the majority of questions. Coles

(1994) even warns us that many of the questions and question formats that teachers use may inhibit intellectual activity. Also the practice of teachers sanctioning resolutions and answers has a negative effect on the development of `critical spirit'. It seems that children are being encouraged to be expert at answering questions and novices at asking them. However the importance of children taking the lead in asking questions can not be stressed enough, according to Hughes and Tizard (1984), as these are `passages of intellectual thought', and given opportunity, children are very good at asking questions (Rosenshine & Chapman, !992; Van der Meij,1992).

Questioning also empowers children, which supports the image of children as powerful and competent humans, promoted by the socio-constructivist perspective of learning. It further supports this view by giving opportunity for learning in a social context. For, according to Mitchell (1992), questioning plays a major role in structuring exchanges in which difference is dialectically produced and fostered as dialogue. In critical enquiry the questions are seen as valuable in themselves and are given status as a crucial part of enquiry. As well, time needs to be accorded to children to think of questions.

Also the relationship between listener and speaker changes; in fact listener and speaker become one. The `listening speaker' poses a question in order to really hear the answer, and perhaps asks the respondent to say more (Mitchell, 1992). She also points out that `. . .the dialogue neither begins or ends, the speaker does not precede the listener or vice versa'. She offers the analogy between asking questions and making a journey:

> Questions contain within them the possibility of journeying, from the past to the future, from the familiar to the unfamiliar . . . in all journeys there are places passed through however transiently. And decisions - to linger, to discard excess baggage, to look at the mountains rather than the sea - are made.
>
> Mitchell, 1992, p.35.

The development of language, in particular conversation, appears to be of paramount importance in the cognitive development of children. For it is through spoken language that one is able to communicate, to argue, to reason, to generate ideas, to express and choose opinions and deepen understandings. It is also language that allows the realisation of thought, which is yet unthought. Thinking and linguistic abilities will grow with increased self-awareness and control as children discover how to plan, evaluate and monitor their own intellectual abilities. Teaching practices which recognise the importance of these factors will therefore contribute to further language and associated cognitive development in all children. What is required is provision in the curriculum for a large `conversational space' where the need of a child to talk is recognised and encouraged. One way to do this is to support their attempts to make sense of the world through the process of critical and co-operative enquiry, which emphasises principles of procedure, rather than just content and knowledge. Subjects can be taught as tools of enquiry rather than bodies of knowledge. Discussion sessions, following Lipman's community of enquiry procedures, which encourage the children's own questioning, ensures that all voices are heard, and individuals treated equally. Teachers need to become co-learners and co-enquirers with children, as well as mediators of discussion and ensure that the rules of reason are followed. Children also need to be given opportunity to work in groups on genuinely collaborative projects in order that peer-group talk has a high profile. What seems essential is for teachers and other adults to respect children's `conversational rights' and their positive capabilities as thinkers. For it seems this is paramount in extending children's control of their language and thinking and hence their potential for successful learning.

Teaching and learning strategies which recognise the importance of language together with understandings of individual differences in cognitive

processing are likely to promote successful learning. Cognitive processing is examined in detail in the following chapter.

4. AN OVERVIEW OF COGNITIVE PROCESSING - Individual Differences in Learning

Knowledge of various aspects of cognitive functioning may help us in our understandings of the nature and processes of learning. It appears that this is a complex field, with many diverse views expressed. For the purposes of this document, findings about aspects such as the ways the brain assimilates, processes and stores information, what is known about the evolution of the human brain and about processing modes in the brain will be reviewed. It is intended that knowledge of these may extend our understandings of individual differences in learning, that is, different learning styles, and serve as an explicit guide for designing teaching strategies which promote thinking and successful learning in all children.

4.1 Assimilating, Processing and Storing Information in the Brain

The human brain is able to remember, to imagine, to feel, to think and to solve problems. It enables us to reflect, to do, and to learn. In understanding cognitive development, it appears that it is necessary to understand the ways the brain assimilates, processes and stores information. Rather than being confined to separate compartments in the brain, these functions appear to be part of an interactive process, which include the working or short-term

memory, accessing information in long-term memory and sensory modality preferences. Understandings of these form the basis of current cognitive models. Whilst information being processed in our brains cannot directly be observed, information can be gathered about what people do when they are processing information and what the outcome of this processing is (Ashman & Conway,1993).

The initial process in a series of processes related to cognitive functioning is that of attention; a process where stimuli in the environment are registered in the brain through the senses on a sensory register. It appears that much information enters the sensory registers, but only a small amount is attended to. For example, how much detail can be recalled of places we have visited or people we've met? Attention appears to operate automatically most of the time, taking in sights, smells, sounds, tastes and sensations, except when we concentrate on a particular stimuli or task. As we become more proficient, our attention moves from a conscious to an automatic action, eg. tying shoe laces, driving a car (Connell,1987, p.5).

Short-term memory, also known as working memory receives items that are attended to by the sensory registers. It can be thought of as the work space or capacity of the brain to hold information for a limited period of time. It appears that the capacity of short-term memory of young children appears limited in that they can only keep in mind a few features of a task. However, it appears that with more experience of a given task (more familiarity, less new features), material becomes chunked into units of meaning, eg. spelling and writing, rules of a game, and enable the person to deal with more information about that task. The more meaningful the situation, the less demand it makes on the short-term memory to attend to strange details. Information is temporarily held in short-term memory by rehearsal and repetition, eg.

learning telephone numbers. Rehearsal is also used to transfer information to long-term memory (Connell,1987, p.6).

In order to make learning more meaningful, it would seem then that new information needs to be presented with attention to introducing only a few features at a time and that, with practice, memory is likely to improve.

Long-term memory appears to be the storehouse of our knowledge of the world. It appears not to be confined to one area of the brain, but stored in interconnected areas of the brain. Evidence suggests that there are certain areas of the brain containing specialised knowledge and processes, eg. areas for language, music, logico-mathematical knowledge (Connell, 1987, p.6).

Information, as a result of interaction with the environment, may be stored as knowledge in long-term memory through both conscious and unconscious processes. Unconscious processes involve automatic storing of sensory information from the sensory registers, while conscious processing includes memorisation and elaboration. Elaboration is the process that people use to connect material to be learned to different kinds of information already stored in long-term memory. The learner possesses strategies for making connections, eg. by recognising patterns and relationships. It means that material can be retrieved by a variety of routes and more easily remembered. Large amounts of information are stored in long-term memory, yet it is possible for particular items of information to be quickly retrieved when needed through the processes of recall (reconstructed) and recognition (automatic). When experiences are familiar, our memory tells us what we see or experience by matching what is experienced with what is in memory (Connell, 1987, p.6).

In what ways do we remember? When we recall an important event in our lives, for which we have a vivid memory, it seems we remember in many

forms. As we imagine being in that particular place, at that time, it is likely we will remember the sequence of events - episodic memory. It is also likely that we will be able to remember or re-imagine the emotions at the time and the visual images. We may also be able to recall physical sensations, such as temperature, light and weather. Some people use sounds and smells as powerful triggers to memory. Certain smells trigger childhood associations. As well as these modes of memory, we can describe past experiences in words. These may also be possible through body language and mime. Recalling and re-imagining are examples of the many complementary forms in which we remember (Atkin, 1989).

Implications for teaching suggest learning opportunities should be available to children whereby activities based on a variety of sensory modes are offered, firstly to cater for the differences in sensory modes used by children in remembering and also to broaden and enrich the learning experience.

Researchers generally agree that knowledge stored in memory is organised into systems of representation and are based on interpretations of experience. In the process of reconstruction, inferences are being made about past experiences in similar situations. We have knowledge of procedures, facts, feelings, sounds, smells and tastes and so on that constitutes our knowledge of the world. This knowledge may be stored as analogues or propositions. Analogues represent concrete knowledge of the world whereas propositions contain abstracted knowledge. For example, the image we have of our car incorporates most of the significant properties and would seem to be stored as an analog representation, while certain facts we know about our car eg where and when it was made and its dimensions etc. are stored as statements or propositional representations. Propositions may also be abstracted statements about sciences, feelings, and spoken or written

language. It is argued by some psychologists that imagery is based on propositions - we construct images from what we know (Connell, 1987, p.7).

Our representations are categorised and stored as declarative and procedural knowledge (Anderson, 1980, 1982). Declarative, sometimes known as conceptual knowledge, is `knowing that', that is, factual knowledge. For example, riding a bike requires knowing facts about where the pedals, handle bars and breaks are. Procedural knowledge, or `knowing how' is the practical information we have of the set of actions or procedures required to carry out a task eg. how to ride a bike. Since most of our procedural knowledge involves declarative knowledge, it is assumed that there are interrelationships between these two types of knowledge when they are stored in memory. It is therefore also assumed that both kinds of knowledge are required for learning.

In order for information to be stored in a way that allows efficient retrieval and use, the brain appears to organise and file information into categories and concepts, based on generalisations, eg. the concept `cat' is made up of essential and most common features (categories based on prototypes) - four legs, fur, purrs, whiskers. Categories can overlap with members belonging to more than one category. Superordinate or higher-level categories are based on more complex generalisations, usually about function rather than appearance. Evidence suggests children form basic-level categories, like cat, apple, chair, before they are able to reorganise these into superordinate categories such as animals, fruit and furniture.

According to Anderson (1976, 1980), conceptual knowledge is viewed in terms of hierarchical networks of domain-specific and domain-general principles, suggesting implicational relationships between primary and secondary concepts.

The term `semantic networks' has been used to describe the interrelations among pieces of information we have about actions, events and concepts. According to Connell (1987, p.7), it is thought that knowledge develops from being largely the knowledge of procedures embedded in specific contexts to become more disembedded and to embrace both `knowing how' and `knowing that'. It appears then that procedural knowledge enables a given body of conceptual knowledge to be realised.

Conceptual and procedural knowledge together with higher-order processes are considered the three major components of a theory of cognition (Evans, 1991) used to explain children's competence, that is, the availability of cognitive structures and processes. These higher-order processes, also known as the executive control, or metacognition (Sternberg, 1986) play a major role in the implementation of procedural knowledge and therefore in the realisation of conceptual knowledge. The higher-order processes are viewed in terms of domain-general processes which operate interactively in performing the role of interpreting, structuring and controlling (English in Evans, 1991, p.72). The main role of the interpreting processes is that of encoding (Davisdon & Sternberg, 1895; Siegler, 1985). The structuring processes, operating at a higher level of executive control, are responsible for knowledge construction and modification (Davidson & Sternberg, 1985). The controlling processes function at the highest level of executive control and are considered significant in the working of the total cognitive system. These include activating the appropriate interpreting and structuring processes at strategic points during task execution, planning and evaluating a course of action by identifying the appropriate conceptual and procedural knowledge components, and evaluating the boundaries (set by the structuring processes) within which generalised procedural knowledge may be applied

(English, in Evans, 1991, p.72). These are considered by Sternberg (1985) to form a continual 'feedback loop' generating a hierarchy of control processes.

According to the cognitive-processing model, it is believed that during thinking, reasoning, problem-solving and acting on objects there appears to be a continual two-way transfer and re-adjustment of information between short-term and long-term memories (Connell, 1987,p.7). It seems that information is retrieved from long-term memory and held in short-term memory while these processes are operating. It appears that the denser the relationship between the pieces of information stored in long-term memory, the more quickly and easily the information is retrieved. For example, a child or other novice with little knowledge or understanding about driving a car will take longer to search their memory for information than an experienced driver. Because of inexperience, this information is also likely to be incomplete. However the expert will have constructed a rich store of knowledge concerned with many aspects of driving, and this knowledge, gained in many different contexts will be stored in many forms, enabling it to be accessed in many different ways when required.

Since a child's knowledge of driving would be limited and largely based on observation, rather than personal experience, procedural knowledge of how a car starts would not be as well organised and retrieved as quickly as the retrieval of factual knowledge of cars.

It appears that a considerable amount of our knowledge is linked to specific areas of experience, and that things learnt in one context or subject area are not automatically available to be used in other areas. A considerable amount of thinking and problem-solving seems specific to the area of experience in which the task occurs. However, certain areas of knowledge are applicable

across contexts, eg. ordering, classifying, and applying language to new situations (Connell, 1987,p.8).

If we accept a constructivist view of learning, then learning is more than just remembering. We need to be able to identify patterns or regularities in events. We need to integrate new experiences with previous experiences. It would seem that engaging many modes of memory through direct experience and the deliberate promotion of reflection processes through the use of strategies to identify patterns and integrate experiences with previous experiences is essential for learning with meaning (Atkin,1989). It would seem that the teaching of general, transferable and critical thinking skills might facilitate learning with meaning. For it seems that the more complex the cognitive structures are and the greater number of cognitive processes available to the learner, the more likely they are to become efficient thinkers and successful learners.

4.2 The Evolution of the Human Brain

Further understandings of the mental processes of the brain may be sought through drawing on what is known about the evolution of the brain. According to a proposal made by MacLean (1978), the brain has three main evolutionary levels; the first brain, or reptilian brain which is driven by instinct, the second brain or limbic system involved with emotions, and the third or cortex brain which is the abstract thinking centre which is believed to be most adept at learning new ways of adapting and coping.

The first two brains control the body's more involuntary responses such as fight or flight response to fear, whereas the third brain appears to be responsible for more voluntary behaviour and capacity for thinking, speaking,

and acting in a deliberate way. It is suggested that under threat we become less flexible, and only the instinctive part of the brain functions. Hence for optimal learning, integrating activity through all parts of the brain, we need to be challenged but not threatened. This may vary between persons depending on past experiences and self-perception.

4.3 Processing Modes of the Brain

As well as attempting to understand the ways in which the brain processes information using short-term and long-term memory to organise knowledge into systems, it has been suggested by some researchers (Atkin, 1993), that the brain has two quite distinct ways of processing information attributable to its two hemispheres. The two processing modes have become known as `right-brain' processing and `left-brain' processing, and it is claimed that each have characteristic processing functions. Right-brain processing, it is claimed, is holistic in nature, concerned with pattern-making, wholes, images, and connections, while left-brain processing is more logical and analytical, concerned with words, numbers, parts, sequential and linear arrangements (Williams, 1983).

It is claimed that for each situation we find ourselves in, we have available to us distinctly different, complementary modes of processing. For example, when unscrambling the letters TLLAFOOB to form a familiar word, we draw on the left-brain processing in order to work in a systematic, step by step approach, eg. we would work logically through known words beginning with T, then possibly L and so on. However the process is assisted by the ability of the brain to recognise patterns of letters (right-brain processing) and often in a non-verbal flash of insight the solution is found. In looking for clues it can often miss out steps and go straight from A to D unlike left-brain processing

where the brain needs to work through A to B to C to D in a linear, sequential manner. Often in problem solving, it appears many people move back and forward between right and left-brain processing.

According to Atkin (1993) left-hemisphere processing seems to provide the basis of our verbal, analytical, objective way of knowing, while right-hemisphere processing seems to provide the basis for our subjective, intuitive, non-verbal ways of knowing.

She also argues that learning associated with left-brain processing is often rote and more easily forgotten whereas learning which is rich in making connections and gaining insights is often more meaningful. She therefore argues that right-hemisphere processing is critical for learning with meaning, although she claims it is not sufficient alone for meaningful learning. For Atkin (1993, p12), 'effective learning with meaning involves the integration of feeling, experiencing, thinking (analytically as well as intuitively) and acting - integration of our many ways of knowing'.

An extension of the two hemisphere model of brain processing has been offered by Ned Hermann in his book, The Creative Brain (Hermann, 1989), where he develops what he calls 'The Whole Brain Model' of learning, thinking and doing. In it he identifies four main processing modes, located in four quadrants of the brain, with each mode a cluster of specialised, but similar processes. The Logical Mode is involved with gaining information, that is, facts, and is found especially in the use of language, rules, principles, laws to represent experience and meaning. The Applying Mode, or Being Able To Mode is involved with acting out and experiencing. The Holistic, Intuitive Mode is used in making connections, insights, and understanding, being a reflection on the experience in the mind's eye. The Emotional, Interpersonal, Kinaesthetic Mode is related to experiencing and doing.

These processes, Hermann (1989) argues, result in a variety of learning styles and thinking styles. His model attempts to account for our different ways of knowing the world; our different ways of responding to the world. We experience - we know how we feel, we intuit, we analyse, we act - we learn.

Just as most individuals show a preference for handedness, Hermann (1989) argues that individuals have preferred thinking styles, that is, individuals differ in the way they favour or prefer the different ways of processing - the different ways of thinking and knowing. It is necessary here to distinguish between `preference', `capability', and `capacity'. The fact that some individuals prefer to process information or solve problems in certain ways does not mean they are not capable of using other modes. It does not mean that they are unable to become more proficient in the use of less preferred modes.

What this whole-brain approach does, according to Atkin (1993), is to help individuals to understand themselves and others and suggest ways in which the less preferred modes can be accessed and developed. This model accepts that we all have a functional whole brain and that we are all capable of developing all its modes in order to promote different ways of knowing and learning. This is in contrast to some other learning style or thinking style models which put you in a `box' with abilities restricted to part of your brain.

People's preferred ways of learning may not be necessarily restricted to one quadrant, though it is possible for one or more quadrants to dominate. This does not mean that people do not access or use the other modes.

The application of this position by Atkin (1993) states that a person whose brain dominance is in the Lower Left (Planned, Organised, Detailed, Sequential) or Lower Right Limbic mode (Emotional, Interpersonal, Feeling-based, Kinaesthetic) will probably like to learn from experience, from

interacting with others, and have certain spontaneity about his approach, but will still prefer a certain degree of order and structure to the task. The learner will not require a need for strong theorising in learning.

On the other hand, a person with dominance in the Upper Left Cerebral Mode (Logical, Analytical, Quantitative, Fact-based) and Lower Left Mode (Planned, Organised, Detailed, Sequential) will require a great need for structure, in terms of what is required and by when. The learner will want to know facts, sequence of events, and have preferences for building up parts into a whole and will prefer to focus on one thing at a time. A learning environment which is unstructured and open-ended will make them feel uncomfortable.

A person who has a fairly even distribution of preferences for each of the quadrants with a slight dominance in the Upper Right Mode (Holistic, Intuitive, Synthesising, Integrating) is likely to engage all thinking modes in learning, but may show a tendency towards needing to see the `big picture' and a need to understand `why' (Adkin, 1993).

Among the numerous implications of Hermann's model of preferred thinking styles is the possibility of the deliberate use of specific strategies to promote and invoke different ways of knowing. By making explicit both the nature of our different modes of thought and the nature of the thinking processes critical for learning, then teaching strategies can be used to match preferred learning styles. Atkin (1993) suggests that different learning styles suit different learning tasks. She argues that it is not just a matter of teachers teaching to all styles, using teaching strategies which engage differing processing modes in order to reach all learning styles. Rather, for effective learning, problem-solving and performing, Atkin highlights the importance of applying the appropriate style of processing to the task.

What Atkin suggests then, is that if we can identify the processes which effective learners, thinkers, problem-solvers or performers use, both naturally and unconsciously, we can then help others to use these processes for particular tasks. Effective learning then, implies identifying and teaching effective strategies.

Thus, an understanding of thinking processes and preferred thinking styles could give us a much more explicit understanding of individual differences and what could possibly be attempted to maximise children's potential. Intelligence, according to this approach then, is not something one has a lot or a little of. Not only is intelligence not one thing, but it is not fixed. In fact this approach means that we can learn to become more intelligent.

This view that intelligence is not a single competence, nor restricted to a narrow set of competences, is not fixed, and is able to be modified and developed in individuals, is supported by Gardner's theory of Multiple Intelligences (1983). He condones traditional Western views of intelligence that have tended to focus views of intelligence on logical and linguistic problem solving. He sees a much greater range of individual strengths, which he claims play a vital role in human society. He proposes seven major areas of intelligence or seven major competences. They include verbal/linguistic intelligence, logical/mathematical intelligence, visual/spatial intelligence, body/kinaesthetic intelligence, musical/rhythmic intelligence, interpersonal and intrapersonal intelligence. Although Gardner (1983) claims these areas of human intelligence are built in, he recognises that they are realised through their interaction with the environment. In passing through a domain, we move from `novice' to `apprentice' and then to `expert' status.

These multiple competences or capabilities, claimed to be recognisable in all individuals and needing to be further developed for living in a complex and

fast-changing world are also recognised in the document of the Department of Education and the Arts, Tasmania; Our Children: The Future - A Curriculum for Children (1991). Curriculums for primary schools, it is stated, should be continually developing and employing five sets of capabilities - personal, linguistic, rational, creative and kinaesthetic capabilities in order to explore and investigate their world. It is suggested that this be achieved through the study of seven inter-related fields of inquiry - mathematics, health and personal development, sciences, social education, the arts, and technology.

What then, are the implications of these views for education? All children have the potential to develop in wide areas, though children may have natural abilities in certain areas, but not necessarily in all areas. It would seem that education is important in facilitating the movement of children through many domains in a variety of ways. If an individual is exhibiting a certain flexibility in his thinking/learning style, then his performance can be improved by him being more conscious of what constitutes appropriate processing for the task. He will then be able to employ deliberate strategies to enhance this processing.

According to Atkin (1993), understanding preferred styles of processing and recognising when and how to consciously control thinking and processing is a large part of what learning to learn is all about. Teaching practices therefore need to facilitate the appropriate processing required in thinking and learning and the effective use of particular strategies.

4.4 A Summary of Major Factors Affecting Individual Learning

The choice of learning and processing styles used by individuals seems to be affected by many factors, facilitating or inhibiting the effectiveness of the

individual's learning. These factors will influence whether the child learns, what he or she learns, how much can be learned and the type of learning that takes place. Some of the variables may be beyond the direct influence of the teacher, though these will play a significant part in the teacher's choice of action or strategies. Individual differences in learning can be broadly attributed to three major factors - information processing, personal and social factors and cultural factors (Ashman & Conway, 1993).

Within the area of information processing, differences occur due to the preferred learning styles of individuals, the different thinking modes, and the cognitive or developmental levels of the individual. An examination has already been made of how individual's developmental levels affect their learning and thinking. It appears that the more advanced the concepts exhibited by children, the more efficient they are in the processing and organising of knowledge into concepts, and the more advanced types of logical operations they are able to use. Individuals differ in the ways they use their short-term memory, their ability to access information from their long-term memory and their sensory modality preferences. During information processing individuals exhibit a variety of thinking processes and preferred thinking styles, and employ a variety of strategies to enhance this processing. Metacognition, or the ability to recognise when and how to consciously control thinking, appears to vary markedly between individuals.

Personal and social factors also affect children's learning and thinking. How we think, what we think about and how we carry out our thoughts partly depend on what kind of person we are, our attitudes and feelings about our competence, and whether we are willing to take risks and be flexible. These factors also contribute to differences in individual learning styles. The socio-constructivist theory of learning promotes the value of these individual differences in learning.

Emotions can have both negative and positive impacts on cognitive performance. Situations which children find threatening and difficult, as when faced with the unfamiliar, contribute negative attitudes to the task. Children see themselves as less able than others to perform and so fear failure; this having adverse affects on the quality of their thought. This can affect their motivation. Motivation, that is, the learner's desire to become involved and to maintain that involvement is another significant factor contributing to individual differences in learning. Motivation energises and directs behaviour and hence is influenced by past experiences (Ashman & Conway, 1993). Success and failure both affect the way in which students approach learning activities. If children have a history of attainment in school-related tasks, then the more likely they are to be enthusiastic than if the majority of their experiences have been failures.

High or low motivation, according to Ashman and Conway (1993), can be attributed to individual's belief systems which provide justification for their performance. These include their self-perception of control or lack of it and their emotional response to the school experience, that is, teaching strategies and the relationship between the teacher and other students. It has been shown through many studies (Ashman & Conway, 1993) that process-based instruction, where students are actively involved, has a positive affect on their motivation and the perception they have of their contribution to the learning process and to success. It appears there is a positive correlation between interest, curiosity and enthusiasm and the quality of thought. Motivation to learn tends to be linked with how the learners see themselves. A positive self-image as learners enables the individual to accept problems as challenges through which to learn.

Another important influence appears to be the values held by the child's living community. It is claimed that educational success and achievement is very

much affected by the degree to which the school and the community share common expectations and beliefs related to education.

Cultural factors also influence the use of particular thinking skills. According to Sigel (1994), in Western thought, for example, it is common to think in terms of causal connections, of discovering relationships among discrete events and of placing value on analytic and synthetic activities.

Comparable differences can be found within our own society, based on differing belief systems, eg. creationists and evolutionists in their interpretation of the origin of the human species.

In summary there are a multitude of factors, including information processing, personal, social and cultural factors, contributing to individual differences in learning and thinking. A greater awareness of these factors by teachers may contribute to the selection and use of effective and appropriate teaching and learning strategies to maximise each child's potential. As Donaldson (1978, p.101) explains, `individual differences will always be with us' and `. . . for the teacher, the most prominent individual difference is apt to lie in the ease with which children can be helped to achieve new learnings'. The role of the teacher then, is to try to find out where the child is at and precisely what the child needs. It is not just a matter of waiting for the child to be `ready' to learn, but to be already equipped with other prerequisite skills. According to Donaldson (1978, p.101) `the essence of the teacher's art lies in deciding what help is needed in any given instance and how this help can be best offered.

In the light of the socio-constructivist view of learning, individual differences in learning are seen to benefit the total community of learners. Rather than focusing on their differences, learners are seen as competent and worthwhile contributors responsible for extending the ability of others and encouraging

diversity of understandings in the larger social group. These social interactions tend to increase motivation, with learners seeing themselves in a positive role which is more likely to lead to successful learning. Active learning encourages learners to take control of their own learning, hence promoting independent learning. The following chapter examines the attributes that successful learners and competent thinkers possess and the ways these contribute to successful learning.

5. THE WAYS SUCCESSFUL LEARNERS BECOME COMPETENT THINKERS

Children who are successful learners and competent thinkers appear to possess a number of essential attributes. Children who are successful learners are generally considered as those who have control over their own learning, and in particular possess well-developed processing strategies which they are able to use appropriately and effectively, have an awareness of their own thought processes, together with well-developed self-confidence and self-esteem. These attributes form the basis of many recent models of competent thinking which emphasise thinking in terms of processing. Knowledge of these models may help to increase our understandings of the components of good thinking and inform our teaching practices in order to increase the potential for control and independence and hence the likelihood of individuals being successful life-long learners (Pressley & Associates, 1990). This is in contrast to past models, which highlight instructionally unmodifiable components, and are based on narrower behaviourist views of learning, which emphasise the learning of specific skills and knowledge. There has been a tendency to label some children `learning-disabled' since it is considered they have learning difficulties or deficits. More recently however, and in line with the socio-constructivist perspective, all children are considered different and unique individuals, learning in many different ways. Teaching strategies therefore need to reflect the many ways children learn as

well as assisting individuals to develop effective and appropriate learning strategies in order to increase their potential for successful learning.

We hear of many ways to describe desirable thinking in humans, which is assumed to result in successful learning. They include descriptions of both the cognitive and affective domains of individuals. Good thinkers, according to Gallagher (1985, p.21), have `the ability to absorb abstract concepts, to organise them . . . effectively, and to apply them . . . appropriately.' There are those individuals who exhibit critical or creative thinking, analytical thinking or those who are effective problem solvers. We often hear of those who employ more advanced or more complex levels of thinking (Bloom,1956), being capable of diverse thinking, and being able to produce the unexpected. Good thinkers, it is claimed, are able to transfer their learning from one situation to another, from the familiar to the less familiar and are able to draw on an appropriate processing mode for the task at hand (Atkin, 1993). As well as the ability to generate new ideas, successful thinkers are considered to be those who have the capacity to apply existing ideas to new situations. Good thinkers are also considered for the speed at which they can think, that is, they are able to think spontaneously, as well as their superior retention, their curiosity and their strong need to know. They are often associated with children who ask lots of questions, often using advanced vocabulary and able to express their ideas clearly and fluently. They are also considered for their ability for independence in learning, having control over their learning through both self-awareness and reflective awareness.

5.1 Recent Models of Competent Thinking

It appears there are many factors which interact to influence the effectiveness of learning. As well it seems that the majority of these have the possibility of being modified through appropriate teaching, hence increasing the potential for control over learning. Recent theoretical models of competent thinking (Pressley & Associates, 1990) reflect the complex interaction of the many factors involved, and their potential for modification through instruction. These were developed in response to the emergence of teaching techniques that focussed on the development of process skills in the 1960s and 70s. Even though these models may differ in terms of the specific elements of thinking they emphasise, they are similar in their attempts to explain thinking in terms of processing. Recent theoretical models of competent thinking seem more complete and educationally relevant than earlier models, since they emphasise the components of thinking that may be changed, hence the potential for improved thinking and learning in all children. Autonomous strategy use, according to Pressley & Assoc. (1990), is represented in these models as a complex interaction of many factors, most of which are potentially modifiable through instruction. As well, educational tasks are able to be analysed carefully, so that the processing required to carry them out can be specified. More complete models have emerged as a result of both the current models of good thinking and more detailed knowledge of what constitutes competent performance on specific tasks. Contemporary models of thinking (eg. Baron, 1985; Brown, Bransford, Ferrara, & Campione, 1983; Sternberg, 1985) look at aspects such as the structure of knowledge in long-term memory, in contrast to older models which highlight instructionally unmodifiable `architectural' components such as the sensory organs per se, or the neurological elements of short and long-term memory.

According to many recent models (Meichenbaum,1977; Baron, 1985; Borkowski, Carr, Rellinger, and Pressley, 1991; Nicholls, 1991) the important features of thinking include strategies (procedural knowledge), knowledge about these strategies and about one's own thinking processes (metacognition), knowledge about the world in general (the knowledge base), motivational beliefs and overall cognitive style. These components appear to operate in interaction. Most recent models contain modifiable metacognitive elements, eg. heuristics (Baron, 1985), metacomponents (Sternberg, 1979, 1982), and general strategies and metacognition (Pressley, Goodchild, et al, 1989). Older models of thinking emphasised the `hardware' and/or a few `critical' cognitive processes (eg. Atkinson & Shiffrin, 1968). Recent conceptual models take into account the cognitive, metacognitive, and social-emotional aspects of thinking that affect classroom functioning and can be modified and changed through instruction. Knowledge of these aspects may assist us in making predictions about interventions that may be effective in producing competent thinking.

5.2 Features of a Good Strategy User

One approach to effective thinking then, according to these recent models, is in terms of good strategy use. Not only does this involve using the right strategies, but also co-ordinating the use of effective strategies with a well-developed knowledge base. For it appears that this is what enables learners to adapt to new learning situations through the application of successful problem-solving strategies, and enables more complex levels of thinking and greater control. Among those who have offered Good Strategy User models are Pressley (1986), Pressley, Borkowski & Schneider (1987) and Pressley & Assoc., (1990). According to their framework, a good strategy user is `one

who possesses a variety of strategies and uses these procedures to meet cognitive challenges' (Pressley & associates, 1990). They define a strategy as a process in which a procedure is executed, aimed at improving performance on a specific task. According to them thinkers possess different kinds of strategies.

Task-limited strategies are used for very specific goals in particular domains. These strategies may include `tricks' that aid in the performance of very specific tasks eg. using the `ROY G BIV' to remember the order of colours in the spectrum (Red, Orange, Yellow, Green, Blue, Indigo, and Violet). This is an example of a first letter mnemonic strategy (Morris, 1979).

As well there are more generally applicable strategies. These goal-limited strategies are used to achieve particular goals that occur in many content areas, eg. procedures for reading and comprehending (eg. self-questioning, constructing representational images, activating prior knowledge, and re-reading hard to comprehend sections of text), problem-solving (eg. means-end analysis, working forward), writing (eg. plan, draft, review and revise tactics) and remembering (eg. repetition, relating to previously acquired, associated material).

There are also general strategies, ie. strategies for regulating and promoting the use of other strategies. These include allocating attention to a task, monitoring performance, searching for relationships between the present task and previous tasks accomplished via strategic mediation. As a result of monitoring, information may be generated as to whether the particular strategy is facilitating task performance (metacognitive knowledge). As a result a currently used strategy may be continued, or abandoned to achieve a potentially more effective approach (Pressley & Assoc. 1990).

It appears that strategies are rarely used in isolation, but integrated into higher-order sequences to accomplish complex cognitive goals. Good strategy users appear to continually evaluate the effectiveness of their choice of particular strategies in producing progress towards the goals they have set for themselves.

As well as knowing how to carry out a strategy, good thinkers appear to know when and where to use the strategies they know, the benefits of using these procedures, and the amount of effort required to carry out strategies. This metacognitive knowledge about strategies enables a good strategy user to recognise when particular strategies are appropriate and to decide whether potential benefits of a strategy use are worth the cost in terms of effort. This involves an awareness of their own cognitive activity and how knowledge about `self', the `task' and the strategies used influence performance, as well as methods to regulate their own cognitive processes. This knowledge is considered crucial for autonomous strategy use and transfer of strategies to novel situations (O'Sullivan & Pressley, 1984; Pressley, Borkowski, & O'Sullivan, 1984; Pressley, Goodchild, et al., 1989).

Effective use of strategies, according to Pressley (1986), is also affected by the presence of a non-strategic knowledge base. Sometimes this knowledge base (knowledge of a certain fact) reduces or diminishes the need to execute particular strategies, eg. a child who has memorised a basic maths fact does not need to employ a strategy to solve a problem (Carpenter,1985). However some strategies may be impossible without relevant non-strategic knowledge (Pressley, Goodchild, et al., 1989). The child who has not mastered a basic maths fact will not be capable of using more complex mathematical problem-solving strategies. It is also claimed that a broad knowledge base is often an advantage because it enables the use of particular strategies (Hasselhorn & Korkel, 1980), eg. there is evidence to

suggest that the pre-reading strategy of activating prior knowledge about a topic only improves retention of unfamiliar prose material if the reader possesses a good deal of knowledge about the topic.

As well as strategies, metacognition and an extensive knowledge base, competent thinking may also be facilitated by appropriate motivational beliefs and cognitive styles. Good strategy users see themselves as able to control their own cognitive performance, through positive beliefs about their own abilities. They are therefore motivated to devote effort and attention to strategic processing. This allows the acquisition of new procedures (Clifford, 1984; Mc Combs, 1986). Motivational beliefs are also related to the thinker's cognitive style, where cognitive style is defined as the habitual way that a thinker responds to cognitive tasks. Particular cognitive styles can benefit performance. Good strategy users tend to shield strategic processing from competing behaviours, distractions and emotions (Kuhl,1985). They are neither impulsive not reflective to the point of inaction, but rather, they are `appropriately reflective' (Baron,1985; Meichenbaum,1977). Although they may experience appropriate anxiety when work is not complete, that is, enough anxiety to motivate doing the work, they are not highly anxious and especially not to the point where anxiety disrupts cognition (Tobias, 1979).

5.3 The Ways Effective Strategy Use Promote Competent Thinking

The Good Strategy User, then, co-ordinates the use of a diversity of strategies, metacognitive strategies, positive cognitive styles and appropriate motivational beliefs and an extensive knowledge base. A competent thinker, when faced with a task, analyses the task situation to determine the strategies that might be appropriate. This involves the use of efficient strategies and knowing when and where to use to use particular strategies,

exerting effort towards meeting a goal in the belief that appropriately extended effort will lead to competent performance and co-ordination of strategies to accomplish complex goals. For familiar tasks, appropriate strategic procedures are used automatically. However when faced with less familiar tasks, the good strategy user analyses the situation and attempts to identify similarities or patterns between the current problem and more familiar tasks so as to activate strategies associated with that previous situation. An orderly strategic plan is then formed for executing the strategies, and performance is monitored during strategy execution to determine if progress is being made towards cognitive goals. In the face of difficulty, ineffective strategies are abandoned in favour of more appropriate ones. These processes are supported by appropriate motivational beliefs that promote good thinking (believing one can become a better thinker by learning and using appropriate strategies) and acquiring world knowledge. Possession of extensive world knowledge, especially about cultural and scientific categories of information, are important to know in order to comprehend events and function completely in contemporary society. There is also the presence of cognitive style that supports competent thinking, that is, appropriately reflexive and attentive, but not overly anxious (Pressley & Assoc.,1990).

Selection, conscious execution and monitoring of strategies consume short-term capacity according to Baddeley (1980), Case (1985) and Kahnemann (1973), and it is claimed that all these processes become more automatic with practice, hence requiring less capacity with additional experience (Logan, 1985; Schneider, Dumas & Shiffrin,1984).

Important aspects of Pressley's Good Strategy User Model are also reflected in Hermann's (1989) Whole Brain Model of learning, thinking and doing. Atkin (1993), in reference to this model, regards the most effective learners as those who have internalised what they have learned and can transfer their

learning to new situations and have generally engaged whole brain processing in the learning process. They are able to integrate their experiences, their feelings, their reflections and their actions. Atkin (1993 ,p:18), claims that when effective learners are exposed to new information they ask `What is that like? What is an analogy/image/pattern that applies? What is an example of this? How does this relate to other examples/situations I've experienced? Now let me see.'

This is further supported by Short and Weiss-Benchell (in McCormick, Miller & Pressley, 1989). They claim skilled learners are able to balance their cognitive skills, metacognitive skills and motivational styles by remaining constantly aware of four critical factors, the characteristics of the learner, the demands of the task, the nature of the materials and the learning activities possessed by the student and those required of the task.

Recent classroom research (Evans,1991) suggests that children who have some basic skills and knowledge are more able to effectively use processing strategies. Research also suggests that children who are taught particular strategies appear to have superior performance on specific tasks. The particular order in which certain strategies be taught for maximum effectiveness would seem to depend on the past learning experiences of children. It would also seem that particular strategies for all kinds of thinking don't necessarily have to be identified, since competent strategy users are able to implement their own strategies. However, the more strategies children possess, including a range of task-limited, goal-limited and general strategies, the more likely they are of successful strategy selection and associated competent performance.

5.4 The Social Components of Competent Thinking

So far, competent thinking has been examined in terms of the effective ways individuals think and learn. However, proponents of the socio-constructivist view of learning argue that the most powerful learning is social in nature and that all children have the potential to be competent, powerful and independent learners. Therefore, we might assume that collaborative and co-operative approaches to novel problem-solving or working on specific tasks should increase the potential for effective strategy use and its resultant competent thinking and increased performance in learners. Individuals bring a range of views to the learning situation, due to their different backgrounds and experiences. It is also a widely held view that opportunities for working collaboratively increase motivation and self-esteem, important factors in effective strategy use. This would seem to favour the use of inclusive rather than exclusive teaching practices.

5.5 Overcoming Learning Difficulties

Some current practices are based on the view that particular children have learning difficulties, hence they are often labelled `learning disabled'. It has been assumed they have something wrong with them, are deficient in something, or else they have an inherent inability to learn (Bell & McCowan, 1992). This `deficit model' has been the basis historically for support programs in schools. It is argued (Bell & McCowan,1992) that this has resulted in teaching practices which further disadvantage these learners, since they have tended to be isolated from the `normal' classroom into `special' programs. Instead of helping learners with difficulties, it is felt that `dependent, powerless, unmotivated and poorly socialised learners' are being created (Bell & McCowan,1992, p.1). Ryan, Short & Weed (1986) and

Jorgensen (1977) refer to children who exhibit apparent strategy deficits as `passive or inactive learners', who are predisposed to failure, even when their cognitive skills are in tact.

However, enlightened educators are beginning to challenge the assumption that there is something wrong with students, or that they have an inherent inability to learn. Cambourne (1990, p.291) states that `school settings put learners at risk by erecting barriers to learning', and proposes that `when learning fails to occur in otherwise normally functioning persons, it is because of a breakdown in the processes which underpin effective learning and teaching rather than a breakdown, failure or deficit in the learner.' According to Bell & McCowan (1992, p.1), we need to `restructure the learning situation rather than restructure the learner.' Teachers, then, need to broaden their views of children and their specific needs, and provide a variety of ways for them to learn. For it appears this will help to increase their potential for future success in learning.

5.6 `Best' Teaching Practices which Promote Effective Thinking

In the light of these findings, what then should form the basis for `best practice' in order to encourage effective thinking and increase the potential for greater control over one's learning? Firstly, we need to incorporate effective ways to develop cognitive skills, metacognitive skills and motivational styles in an effective balance through classroom teaching practices offered to children. Current `best practice' incorporates a learning environment where all children are seen as potentially effective learners and are provided with a variety of ways in which to learn in order to meet individual needs. They are seen as valued learners whose contributions are also equally valued. Children are to be encouraged to take control of their

learning, by recognising that success comes through their own effort and persistence, along with support from others. Learning therefore needs to take place in a social context, through co-operative means, allowing for the development of effective relationships and the efficient sharing of knowledge. Learning situations which allow learners to integrate their experiences, their feelings, their reflections and their actions are likely to facilitate the transfer of learning to new situations.

If the steps or processes towards successful performance of tasks commonly encountered in the classroom can be carefully identified and analysed, that is, the strategies children need to execute to do a task well, then this can be incorporated into our teaching practices and hopefully result in more efficient and successful performance. Teachers need to model these learning strategies regularly, along with questioning strategies, and in a number of different situations. As well, teachers need to model where and when to use particular strategies. This process should then facilitate the individual's choice and use of effective strategies and also maximise their efforts. Teachers also need to provide adequate opportunity to practise these to increase their efficient use. Teachers need to be mindful that individuals differ in the amount of practice required to become competent at a particular task, with opportunities given for success at less complex tasks before attempting more complex tasks.

Learners need to be taught a wide range of processing strategies, to increase their chances of selecting successful strategies. These need to include a range of task-limited, goal-limited and general strategies. However, children are to be encouraged to implement their own strategies, since it is impossible to learn thinking skills for all learning situations. These need to take the form of general adaptive problem-solving strategies that can be applied to novel situations. For an essential element in possessing life-long learning skills is

the ability to direct, plan and monitor one's cognitive processes in unfamiliar situations.

For it is through becoming competent in the use of these skills and strategies, through appropriate language experiences, that children become active learners, being able to take control of their own learning and become powerful, independent and successful learners - the basis of the socio-constructivist perspective on learning.

6. DEVELOPING THINKING SKILLS

In order to become successful learners, it appears that children require a diverse range of thinking skills. Schooling over the last 50 years has reflected a changing emphasis on the importance of particular thinking skills. Current thinking promotes the ability to use thinking skills which are considered to be the `building blocks' of thinking and essential for all children to be able to use if they are to take control of their own learning. These include both lower and higher-order thinking processes. Some thinking is domain-specific while there are some skills that are applicable to all domains. It is generally acknowledged that thinking skills are able to be taught and reinforced in school and that the more aware children are of their thinking processes, the more effective their thinking and learning will become. Some educationalists consider students benefit more from the teaching of thinking strategies in detached contexts (DeBono,1976a,b; Lipman, Sharp & Oscanyan, 1980; Lipman,1988), while others favour them embedded in particular subject domains (Glaser,1984; Joyce,1985; Schoenfeld,1988). Some promote a combination of these (Nickerson,1989). It is also considered that all children can reach high levels of thinking, even quite young children. In fact, young children starting school bring with them their own set of informal problem-solving skills (Donaldson, 1978; Hughes & Tizard, 1986; English, 1988; Clay, 1991). However, children appear to think and learn in a variety of ways, using a variety of skills. Biggs and Collis (1991) stress the importance of multi-modal functioning in order to develop thinking. In what ways can teachers understand and use this knowledge about thinking in order to provide

teaching and learning strategies that will contribute to the development of a genuinely educated person, able to think for themselves, to take active control of how they go about learning, to achieve autonomy and some self-fulfilment in their lives?

What make up the traits and character of a genuinely educated person? An historical look at educational practice highlights the changing views of this. Exponents of Behaviouralist Theories have understood an educated person to be one who possessed specific knowledge and skills necessary to equip them for the workforce. Those supporting Cognitive/Development Theory, especially the views of Piaget, perceived successful learners as those able to seek explanations and understandings through their interaction with the environment. Sigel (1984), perceived an effective thinker as one who could recognise and resolve discrepancies. Coles (1994), describes a genuinely educated person as possessing such things as faith in reason and intellectual courage. This latter view is in line with contemporary practice which promotes independent learning within a co-operative learning environment through discussion and debate. For it is this practice which is seen to promote the development of life-long learning skills which enable individuals to adapt to and contribute to the future well-being of a complex and rapidly changing society.

Often in contemporary practice, reference is made to cognitive operations such as remembering, generating ideas, posing and solving problems, of abstract reasoning and logic, of creative, analytical and critical thinking. These are some of the skills related to thinking, which can be categorised into lower and higher order functions (Bloom, 1956).

However earlier this century, in response to the behavioural model of learning, student thinking and teaching has been mainly focused on simple or

lower order thinking, that is, remembering or memorisation. This has been so called because the thinker doesn't have to apply any strategy to process the remembered information. It is generally known as `knowing that' or conceptual or declarative knowledge. However, when students are asked to solve a problem, make a decision, make a generalisation, identify patterns in a sequence, or distinguish facts from inferences, they have to remember and apply strategies to process information in each of these ways. This is `knowing how' or procedural knowledge (Anderson, 1982).

Traditionally schools have emphasised content in the curriculum. However in this information age, it is argued that students need more than a good memory for current curriculum content. They also need higher order skills in thinking analytically, creatively and critically. Recent educational documents such as Our Children: The Future, (Tasmanian Department of Education & Arts,1991), National Curriculum and Profile Statements (Australian Educational Council, 1991-1994) and National Key Competences Statements (1993) represent these views. Given our complex and fast changing economic, social and political structures today's students, it is argued, need to be equipped with a wider range of thinking strategies than those of the past.

Many educators assume that students develop these information strategies quite naturally, but research, according to Langrehr (1993a), shows that there is tremendous variety in the quality and quantity of students' thinking strategies. Some students have simply never been taught strategies for judging the relevance, bias or reliability of information, for recalling lists of names, for thinking creatively, for analysing the structure of a design or for summarising a reading. For effective thinking, he argues, children need to be aware of a wide range of appropriate thinking strategies and the sequence of steps involved in their use (Langrehr,1993a, pp. iv-v). This view is supported

by findings in the previous chapter regarding effective strategy use. Teachers, then need to model a range of thinking strategies in a variety of situations in order to enable children to use them appropriately and effectively. For it seems that this enables individuals to deal with novel situations and develop independent learning.

Yet as teachers we need to be mindful of the abilities that children possess as thinkers. There is evidence (Donaldson,1978; Hughes & Tizard, 1986; Clay, 1991; English in Evans, 1991) to suggest that young children come to school with their own set of informal problem-solving strategies and are able to solve cognitively sophisticated tasks when these are presented within meaningful contexts (Dias & Harris, 1988; English, 1988). Therefore teachers need to provide a range of learning situations to enable children to apply the diverse range of cognitive skills they bring to school.

There appear to be a wide variations in children's thinking. Biggs and Collis have worked extensively with other psychologists to try to identify and explain the variations in the development of children's thinking. They see modes as crucial elements in this development. They define modes as characteristic ways of thinking and representing content. Through interaction with the environment, including the development of language, the child begins to develop from birth a range of thinking modes.

As mentioned in Chapter 2 Biggs and Collis have identified 5 modes of thinking, all of which are seen as crucial elements in developing children's thinking. The Sensori - motor mode is associated with constructing meaning from experience gained directly through the senses and through movement and is the only mode available to very young children who have not yet developed language. In the Ikonic mode of operating, and with the help of oral language, children create images and use linguistic descriptors (direct

symbolism) to represent their experience as they interact with the environment. Children begin to construct intuitive knowledge. The Concrete Symbolic mode is characterised by the use of written, second - order symbolic systems such as written language, mathematical symbols and musical notation. Learners are able to construct declarative knowledge. In the next or Formal mode, children are able to construct and manipulate theoretical knowledge by using abstract reasoning to hypothesise about alternate ways of ordering the world. The final and most advanced Post -formal mode marks the learner's ability to question conventional bounds of theory and practice and establish new ones.

Current theorists suggest that all these modes of thinking are equally valuable, each mode developing and co-existing with its predecessors. This co-existence, Biggs and Collis (1992) claim greatly enhances `modal repertoire' - the ways in which a learner thinks and represents content. As well it increases the variety of strategies a learner has at his or her disposal for problem - solving.

Teachers therefore need to use a variety of teaching and learning strategies that foster multi-modal functioning in order to encourage optimum, life-long learning.

Students also need to develop metacognitive skills which affect the overall management of learning and action. Metacognition is being aware of one's own thinking processes and then using this awareness to control what one is doing. As well as `knowing how' to carry out a strategy, students need to know when and where to use the strategies they know, the benefits of using these procedures and the amount of effort required to carry out strategies. These processes are viewed in terms of a hierarchy of domain - general processes which operate interactively in performing roles of interpreting,

structuring and controlling. Metacognition is not a separate strategy but runs through all levels of thinking (Evans, 1991).

The central position of this paper is that all students, not only the gifted, need to learn lifelong thinking strategies, and that traditionally disadvantaged groups such as those related to gender, class, culture, race, religion, physical or mental state, and physical location are no exception to this. For current views on `equity' in education, expressed through policy statements such as the Inclusion of Students in Regular Schools (Educational Branch, Tasmania, 1994) and the National Action Plan for the Education of Girls (Curriculum Corporation for the Australian Education Council,1993), relate to all children having equal opportunity to develop and have confidence in their cognitive ability as they face, tackle and solve new problems.

The following core thinking skills have been identified in the 1987 American Association for Supervision and Curriculum Development publication, Dimensions of Thinking, by teachers and cognitive psychologists over recent years. They are considered to be the `building blocks' of thinking, having a sound basis in the research and theoretical literature. They are also considered as important for students to be able to do and may be taught and reinforced at school.

Focusing skills direct one's attention to selected information by defining problems - clarifying problem situations, and by setting goals - establishing direction and purpose.

Information gathering skills involve the acquisition of relevant data through observing - obtaining information through one or more senses, and through questioning - seeking new information by formulating questions.

Remembering skills assist with encoding - storing information in long-term memory and recalling - retrieving information from long-term memory.

Organising skills allow information to be arranged so it can be used more effectively through comparing - noting similarities and differences between two or more entities, classifying - placing entities in groups by common attributes, and ordering - sequencing entities according to a given criterion.

Analysing skills clarify existing information by identifying and distinguishing among components and attributes. Identifying attributes and components determines the characteristics or parts of something, while identifying relationships and patterns recognises the ways elements are related.

Generating skills use prior knowledge to add new information. Inferring involves reasoning beyond the available information while predicting involves anticipating or forecasting future events. Elaborating involves using prior knowledge to add meaning to new information and to link it to existing structures, while representing involves adding new meaning by changing the form of the information.

Integrating skills involve connecting and combining information, through summarising - abstracting information efficiently and parsimoniously, and through restructuring - changing existing knowledge structures to incorporate new information.

Evaluating skills assess the reasonableness and quality of ideas. Establishing criteria set standards for making judgements, verifying confirms the accuracy of claims and identifying errors recognises logical fallacies.

Most of these core thinking skills can be identified in Bloom's Taxonomy of Levels of Thinking (Bloom,1956). He identifies 6 levels of thinking. His lower order thinking involves remembering and applying information. He names 3

lower order stages - knowledge, comprehension and application. These involve convergent thinking processes. Three higher order, divergent thinking stages are referred to as analysis, synthesis and evaluation.

Bloom (1956) argues that children need to move through these 6 different levels in a logical sequence in order to develop new concepts or learn new relationships, through appropriate questioning techniques. Competence in thinking in the lower 3 levels is required, according to Bloom, before effective thinking can take place in the higher levels. A variety of strategies can be created for thinking at each level. Bloom claims that familiarisation and practice with his model facilitates independent learning. This can be achieved, he claims, through teachers asking better questions and teaching students how to ask better questions of themselves as they study information.

Research by educationalists and cognitive psychologists (Atkin, 1993; Williams,1983; Hermann,1989) during the past decade have shown that good thinkers are quick to perceive relevant patterns in information. This has already been examined in an earlier chapter - an overview of cognitive processing. Good thinkers also ask themselves good, probing questions about these patterns. As well they construct well-connected, visual summaries that they use to link new information with that already stored. Hence strategies devised to teach thinking skills should help students `to notice key patterns in information, to make new connections between concepts, to create their own probing questions, and to construct visual summaries' (Langrehr, 1993, p.1). For this is the basis for teaching children to think creatively, analytically, and critically.

Thinking creatively involves looking for and making unexpected connections between concepts through questioning involving creative reversals, explanations, comparisons, using consequences and alternatives. Skills seen

as important to creative thinking include fluency -generating ideas, flexibility - taking different approaches, originality - thinking in clever or unique ways, elaboration - adding to an idea to make it more interesting or complete, curiosity - encouraging children to be inquisitive, to seek problems and information and ask questions, complexity - seeking many different and often difficult or complex alternatives, risk-taking - having the courage to take a guess, or expose oneself to criticism or failure, imagination - building on mental images, putting oneself in another time and reaching beyond sensual and real boundaries (Dalton,1985).

Thinking analytically involves `seeing' relationships between concepts and differences between such things as causes and effects, facts and opinions, and definite and indefinite conclusions. Critical thinking involves students making judgements, with the use of relevant criteria, about such things as the relevance, reliability and bias of information. Skills important for the development of critical thinking include planning - the ability to organise a way of achieving a specific outcome or goal, forecasting - the ability to forecast future events, communication - the ability to express thoughts and ideas to others, decision-making - generating ideas and solutions, weighing alternatives against certain criteria, making decisions, judgements and choices and giving reasons, and evaluation - weighing up ideas in a logical manner looking at the comparability of these (Dalton,1985).

Problem-solving is another important part of thinking and learning and appears essential for control of and independence in learning. It combines a number of thinking processes. When faced with a novel problem-solving situation, existing knowledge structures are used in conjunction with the application of higher-order thinking processes, creating new knowledge. Such problem-solving experiences include identifying the problem, finding alternate solutions, justifying solution strategies, reflecting on one's actions

and generating new problem situations. Evidence shows that even young children possess a repertoire of informal problem-solving strategies and are able to control their learning in novel situations provided the context is meaningful to them (English in Evans,1991, p.83).

Abstract reasoning, which is an important part of problem-solving is another higher order function in thinking and learning and is associated with reflective awareness, abstraction and control. When faced with alternatives, possibilities are considered and an appropriate choice made in order to make sense of the situation. Again researchers (Donaldson, 1978; Hughes & Tizard, 1986) suggest young children are capable of abstract reasoning as long as the language used is familiar and relevant to their sphere of experience. Through the use of familiar conversational language children are more likely to make meaningful connections which facilitate abstract reasoning.

It appears that all these thinking skills - the `core' thinking skills, lower and higher order thinking skills including knowledge, comprehension, application, analysis, synthesis, evaluation, as well as metacognitive skills, problem-solving and abstract reasoning may be used in a wide variety of contexts. It would also appear that children competent in their use in many different contexts have the potential for increasing their control of learning, especially in novel situations.

However, there are differences of opinion about the most effective ways of learning these thinking skills, that is, whether children should learn them separately - detached from subject domains, or embedded in the teaching of subject domains in the curriculum, or even embedded in integrated subject domains. Some researchers argue that detached teaching of strategies are preferred. For example, De Bono in his CoRT thinking, 1976a, has devised a

variety of teaching strategies to look at ideas and situations in various ways, eg. Plus, Minus, Interesting, Consequences and Sequel, Alternatives and Possible Choices. As well his Six Hat Thinking offers different aspects/perspectives of thinking through looking for information, feelings, strengths, weaknesses, new ideas and thinking about thinking. Others, including Lipman, Sharp and Oscanyan (1980), and Lipman (1988) offer detached thinking strategies through their Philosophy for Children, by creating communities of inquiry. They argue that thinking strategies are not domain-specific, but related to everyday life.

Others, eg. Glaser (1984), Joyce (1985), and Schoenfeld (1988), argue that teaching strategies should not be taught in a general way, emphasising that they are more appropriate in subject-orientated learning situations. It is also argued that teaching detached thinking skills occasionally may not lead to transfer of skills from one context to another as is argued where thinking skills are taught within subjects in the general curriculum. Nickerson (1989) argues there is room for both cases.

It also appears that it may be difficult or impossible for people to learn new thinking skills as abstract statements. Rather they need to be related to some content or familiar experience in order to take on some substance and meaning (Evans,1991).

What seems most important is that thinking skills should be taught in a way that is most likely to enhance the learner's ability to independently solve novel problems. It seems paramount that they should be related to the everyday experiences of the learner, and that the learner is able to see their relevance in a wide variety of learning situations, hence developing the learner's ability to transfer their thinking from one context to another. Current educational documents outlining future directions in education, eg. Our

Children: The Future (Tasmanian Department of Education and Arts, 1991) suggest that thinking strategies are most effectively developed through the integration of co-operative and community-based learning experiences within the classroom and that the teachers' modelling of a variety of strategies regularly will facilitate their further use independently in students.

Two questions arise here. Is all thinking domain-specific or are there some general skills applicable to many domains? According to Evans (1991), the balance seems to be towards the latter since the rules of logic and reasoning, organising strategies and heuristics - trial and error or systematic elimination of possibilities appear to be the same across all domains. Does greater control over one's thinking result from being aware of and being able to use many specific thinking skills, or rather from the ability to use adaptive general problem-solving strategies? Can thinking strategies be applied in the absence of detailed domain-specific knowledge?

This leads to a further question of whether the learning of cognitive skills should be through explicit or implicit means? According to Evans (1991, p.4), a deliberate agenda to help learners develop cognitive skills does not necessarily imply the explicit teaching of such skills. He argues that if students have pressure to invent or use their own strategies then this will most likely lead students to adaptive learning strategies. If given a suitable task, he believes children can effectively invent sophisticated strategies. It would seem important to encourage learners to invent their own strategies and use general adaptive strategies in order to increase their ability to solve problems in novel situations, and hence increase their control over learning and thinking.

Evidence (Evans, 1991, p.5) suggests that the explicit teaching of strategies may not be as effective as spontaneous discovery. Alternatively, students

need to be encouraged to reflect on the strategies they use and verbalise their methods. This can be encouraged and supported by teachers demonstrating their strategies when solving problems or making decisions aloud, known as reciprocal teaching (Palincsar and Brown, 1984). It is argued that providing students with opportunities to demonstrate and improve strategies will enable them to reach the point where they see it as natural to discuss cognitive processes. This reflection and awareness of their own thinking processes should enhance control.

In what ways does the knowledge base play a part in the development of cognitive skills? According to Evans (1991, p. 6), as skills develop, propositional or declarative knowledge decreases and becomes automatic, eg. as in reading when we are only aware of correcting occasional miscues. Intellectual skills may also develop intuitively without the belief of explicit awareness. Evans (1991) warns us that some skills need to be learnt through explicit propositional knowledge via sequences of procedures. It is this kind of learning that assists in the development of conceptual knowledge structures, `Potentially knowing how', according to Evans, is made up of specific knowledge, relational or conceptual knowledge and strategic knowledge. Actual procedural knowledge may be supported by this propositional knowledge base.

There remains, however, a large percentage of classroom teaching and learning practice primarily involved in the learning of basic skills and knowledge, with little emphasis on the development of general problem-solving strategies. Teachers often fail to recognise the repertoire of informal problem-solving skills that young children first bring to school. Yet it is the child with a confident grasp of a range of adaptive problem-solving strategies, together with multiple modes of thinking, that will more likely succeed in having control over their own learning, and go on to use these skills

effectively in the wider community outside school. Current `best practice' promotes the development of general, adaptive problem-solving techniques in all areas of learning, and not just as one-off activities, from time to time. This is assisted by the use of strategies to foster multi-modal functioning. Teachers need to provide children with a variety of learning experiences to develop each thinking mode along with time and opportunities to explore, investigate, hypothesise and then make conjectures on what their findings might mean. In classroom activities there needs to be ample time for discussion, planning, carrying out the task investigation or experiment, time for rejection of results and time to report to the whole class on findings.

In line with the socio-constructivist perspective on teaching and learning, children need to be involved in a range of novel problem-solving situations, involving the class or smaller groups. Since it is these experiences which are `conducive to the discovery of knowledge and the application of higher-order thinking processes, rather than to the mechanical application of previously acquired rules or procedures' (English in Evans,1991). It is problem-solving experiences such as finding alternate solutions, justifying solution strategies, reflecting on one's own actions, and generating new problem situations (Bruni, 1982; Burns, 1985; English, 1986; Wheatley & Wheatley,1984; Whitney,1985) that will enable children to realise their potential as independent learners.

7. EVALUATING THINKING AND LEARNING PROCESSES

When planning and structuring curriculum programs it is important for teachers to be aware of not just what children know, but also how they think. Socio-constructivist perspectives of learning suggest that the starting point for teaching should be based on individual's ways of thinking and knowing. This is in contrast to traditional teaching practices which have been organised around content objectives or goals which specify that children should know certain facts and be able to perform specific tasks and procedures. It is through becoming more aware of the ways children operate when they engage in mental activity that enables the teacher to intervene effectively, thus tailoring teaching method and content to match the learning needs of the individual (Rowe, 1991). As well, it enables both students and teachers to see the range of thinking strategies, both cognitive and metacognitive skills, employed during cognitive processing in a variety of contexts. Children's reading competence, according to Clay (1991), is a product of the ways children are able to use these processes effectively. Children's potential for more powerful thinking is also facilitated by providing social contexts in which children's thinking can be shared and questioned (Barnes & Todd, 1977; Peret-Cleremont,1980; Bauersfeld, Krummheuer & Voigt,1988; Yackel, Cobb & Wood,1991). Current teaching practices reflect a variety of observation and assessment methods. These include informal observation techniques, anecdotal records, listening to and questioning children, discussion with other children, and/or previous teachers and parents, samples of children's work,

children's self assessment, and specific testing. Observation, assessment, analysis, evaluation and planning are on-going inter-related activities which mutually inform each other (Yackel, Cobb & Wood, 1992).

Socio-constructivist perspectives on teaching and learning assume that children construct knowledge by reorganising their experience in the course of social interaction with each other and with the teacher, and that the starting point for teaching should come from individual children's ways of thinking and knowing rather than a pre-determined body of `content' knowledge (Yackel, Cobb and Wood,1992). Hence this view would seem to call traditional approaches into question.

Traditional methods of teaching and learning, based mainly on the behavioural model, have been organised around content objectives or goals which specify that children should know certain facts and be able to perform specific tasks and procedures that result in a correct answer. Hence success has been traditionally measured quantitatively. By contrast, the goals for teaching and learning valued from a socio-constructivist perspective are not linked to performance on specific tasks. Instead, they are concerned with the nature of the activity the children engage in as they work to solve discrepancies or problems. Yackel, Cobb and Wood, (1992, p.70) explain this in relation to mathematical education. These goals, they claim, include that `children make meaningful, productive and increasingly powerful mathematical constructions and that they develop the ability to engage in mathematical explanation and argumentation'. Assessment of progress towards the goals we value, then, requires repeated face-to-face interactions with students as they engage in and explain their thinking, whether it be in maths or some other curriculum activity. For the teacher, this means asking clarifying questions or probing for information about the children's solution processes and the activity itself. Hence, assessment from this perspective is

intrinsic to the very act of teaching and can only be discussed separately by removing it from the social context in which it occurs in practice.

Recent assessment and evaluation techniques have favoured the use of qualitative measures through a variety of means to enable meaningful assessments of children's learning. These have been used both for assessing individual children's progress as well as a means of effectively evaluating the learning program. For example, The Key Intended Literacy Outcomes, Department of Education and Arts, Tasmania (1993) are designed to provide specific learning outcomes, arranged in suggested developmental stages, in order to assist the teacher in planning for individual children and evaluating the literacy program.

Most effective methods, in line with socio-constructivist perspectives, involve those which give an indication of the ways in which the individual child is thinking. How then can we enter the thinking world of the learner? According to Rowe, (in Evans, 1991), there are many direct and indirect methods which provide procedures for the detection and assessment of important component processes of thinking, problem solving and learning. Each method has its advantages and disadvantages and the choice, according to Rowe, should probably depend on the goals of the study and the age of the student. Another important consideration is that effective probing of children's real ideas and strategies of thinking and learning require a consciously value-free approach without expectations.

Pre-requisites for the observation of thinking and learning processes, according to Rowe, include that observers, eg. teachers, develop

> 1.a knowledge of cognitive processes in humans generally, the strengths and limitations of the processes they and others have developed in relation to different tasks and situations;
>
> 2. an awareness of how they themselves go about tasks;

> 3.an ability to monitor their thinking strategies and actions; and
>
> 4.an ability to make use of the feedback obtained from such monitoring to change what they do, and how they do it, ie. an ability and willingness to consciously take control of and responsibility for their thinking and learning.
>
> Rowe. in Evans,1991, p.10

The importance of the ability to monitor one's own performance is recognised through recent national and state educational initiatives. For example, one of the key aspects of The Key Competences for Work, Education and Life (1993), relates to the ability for effective planning and organising of activities. As well, the Tasmanian Certificate of Education, (Years 9,10,11 and 12) outlines a method of assessment based on the ability of individual students to function according to a set of well-defined learning criteria for each subject area, of which students are made aware in the course of their study.

Rowe (1991) also states that, whether one is talking to small groups or to individuals, it is important to tell students the intention of the exercise, that is, what you are hoping to achieve. In order to make covert processes overt, the student needs to be able to identify and monitor the processes of which he is aware, or can be made aware, that is, metacognitive knowledge and processes. This approach is more appropriate for older children.

A way of finding out how students think is to ask them to report on strategies they are using while engaged in problem solving or learning various tasks. According to Rowe (1991), self-reports such as questionnaires, interviews and verbal reports obtained by the thinking aloud method constitute the major direct methods for the assessment of metacognitive knowledge and skills, while indirect methods include the observation of spontaneous private verbalisations, and the use of rating scales, performance and behavioural analysis. Each of these methods have certain strengths and weaknesses.

Rowe warns about the need for caution in the interpretation of data from self reports. Questions arise as to the extent to which information is accessible to a person's awareness and the extent to which the reports represent realistic and personal accounts of personal experience. It has been suggested by Rowe (1991) that verbalisation itself may affect normal cognitive processes, and that the ability of the student to remember what he or she experienced strongly affects the validity and reliability of post-performance verbal reports.

According to Rowe (1991), the success of questionnaires consisting of open-ended questions, interviews and thinking aloud depends on the individual's ability to express his or her thoughts, strategies and experiences verbally and also on his or her motivation to offer a report. Rowe (1991) suggests that open-ended questionnaires tend to elicit a considerable degree of fabricated responses. Questionnaires and interviews also depend on the student's comprehension of the questions asked by the interviewer, as well as whether students are reporting what they feel they ought to have been thinking.

To facilitate accessibility, validity and reliability of post-performance results, Rowe (1991) suggests adhering to the following points. Conduct the interview as close as possible to the performance, establishing a good rapport with students beforehand. Encourage students just to provide verbal descriptions of subjective cognitive experiences, minimise probing and analyse the internal consistency of verbal reports.

According to Rowe (1991), various procedures may be adopted in assessing metacognitive processes by interview. These will be based on the type of task, the setting and the age of the students in order to determine the style of the interview. Also one needs to consider the variables one wishes to observe, and the criteria by which they are to be measured.

According to Rowe, (1991) open-ended questions provide potentially richer sources of data than fixed-choice questionnaires. However the time required and the difficulty in scoring the responses are seen as drawbacks.

Some of the difficulties arising from the use of the interview and questionnaire might be alleviated, according to Rowe (1991), if interviewing was conducted concurrently with cognitive performance. By using questions and probes during various stages of performance metacognitive knowledge, and the use of executive strategies may be assessed. In this way a better understanding of what makes a person perform in a certain way is achieved by integrating task performance, procedural, environmental and metacognitive operations. This could enhance the learning process, (Vygotsky's zone of proximal development,1962), but caution needs to be taken, since too much additional information processing may interfere with both metacognitive and cognitive processes.

Thinking aloud methods require the subject to verbally express all thoughts, actions and feelings that come into his or her mind during task performance, without interpretation and inference. All utterances are recorded onto audio-cassettes and are subsequently analysed. These appear to provide the most frequent source of data in contemporary studies of cognitive processes. Overt verbalisation and private speech have been considered important in the development of one's self-control in learning (Vygotsky,1962). However others doubt the completeness, objectivity, validity and reliability of self-reports.

The main advantages of both the thinking aloud and open-ended interview is they don't constrain subjects to predetermined alternatives. Rather than just emphasise purely cognitive processes, the thinking aloud and open-ended interview give the researcher opportunity to see how cognitive processes may

be set in action and modified by motivation, emotions, metacognition, self-image and the content and structure of memory. It is considered that all these factors are important for a comprehensive description of human information processing.

A mixture of direct and indirect methods seem to be effective in assessing the thinking of young children (Rowe, 1991; Jackel, Cobb, Wood, 1992; New & Mallory,1994). Interviewing young children about their thinking during performance may include the use of dialoguing for eliciting thoughts about a particular difficulty or problem, using non-threatening questions relating to choice of strategies, matter-of-fact tone of speech, and guiding the child to evaluate his or her proposed solution to the problem. As well the teacher may take on a role of puzzlement, seeking clarification from the child (Karoly,1981). New and Mallory (1994), promote documentation and assessment of children in Early Childhood Education, through the use of slides, audio tapes and video, as they solve problems, play and talk with each other. Jackel, Cobb and Wood (1992), recommend that teachers provide opportunities for as many face-to-face interactions as possible with children as they engage in or explain their thinking.

A way of indirectly assessing an individual's awareness and knowledge of metacognitive skills, according to Rowe (1991), is to ask him or her to rate the certainty of the correctness or incorrectness of a previously given answer. It has been found that metacognitively aware students will respond that they are relatively certain about their correct/incorrect responses. As well evidence of metacognitive awareness in students might be obtained by monitoring their self-corrections during cognitive activities and thinking aloud protocols. Metacognitive processes may also be detected by observing performance without the use of verbal reports. We may be able to observe the ways subjects combine strategic skills and apply them to the task.

Simulation or role playing, peer teaching and cross-age tutoring are other indirect methods of investigating cognitive processing. As well forced-choice, rank-ordering or rating-scale methodologies can indicate the significance for individuals of various cognitive and metacognitive processes, and how these interact. However caution needs to be taken since it is felt these methods may lead to an overestimate of metacognitive knowledge and skills, as well as limiting responses (Rowe,1991).

Since all methods have strengths and weaknesses, Rowe (1991) claims the choice of methods will probably depend upon the goals of the study and the age of the student. For young children where verbal responses may be the main concern, forced-choice procedures or inferences from behaviour may be preferable. On the other hand, for older students verbal reports may be more appropriate. Rating-scale procedures may be particularly useful for examining one or a limited number of variables in depth. In order to make valid, reliable and complete assessments of the cognitive and metacognitive knowledge of individuals, the use of a combination of techniques is to be encouraged.

It can be seen then, that there are a diverse range of methods for `observing' the ways children think which assist teachers in assessing and evaluating children's learning. It appears that `observing' the ways children think, and the range of strategies they use during learning activities are valuable means of planning effective learning activities which are likely to increase the potential for greater control over their learning. For, as has been argued previously, it is the child's ability to effectively monitor cognitive and metacognitive processes in novel learning situations that leads to greater inner control, hence increasing the potential for successful learning.

This can be shown through `observing ' young children learning to read. Clay (1991) hypothesises that the competence of children's reading when faced with novel situations is the result of the child's ability to effectively monitor cognitive and metacognitive processes. Children become successful readers when they are aware of specific skills and know how and when to apply them. By self-correcting errors as they strive for meaning, they increase their skills and facilitate their development towards becoming independent readers.

In order to provide effective teaching strategies to enable young children to become independent readers, teachers need to be aware of the following major considerations (Clay,1991). What are the cognitive processes in action? That is, what cognitive resources (knowledge and processes) do children bring to novel reading situations? As well, we need to be aware of the ways these may be set about and modified by motivation, emotions, metacognition, self-image and the content and structure of memory. Not only are we interested in the thought processes, but also in the interaction between the structures of knowledge and the cognitive processes in knowledge. According to Clay (1991), it is through connecting new knowledge with old knowledge and modifying old knowledge that effective learning takes place - the `constructivist' view of learning. What changes take place in children's cognitive resources during problem-solving and to what extent do children control these changes? What evidence is there that they are inventing their own strategies? Through `observing' these considerations in individual children while reading, it is intended that a better understanding of the ways children learn to read will be possible. In turn this should enable teachers to provide appropriate teaching strategies that will enable all children to learn appropriate skills on their way to becoming competent readers.

In what ways can a theory of reading assist in our `observations' of young children learning to read? For this we will examine a theory of reading

proposed by Clay (1991). She proposes that through early reading and writing experiences, the learner creates or constructs a network of competences which generates further learning. Children come to know reading in two ways; firstly, as a process of actively reconstructing meaning and secondly as a process of predicting one's own way through print. Reading, then, is a problem-solving activity in which the child constructs effective processing strategies. The child becomes aware of what he is doing and actively engages in searching and checking. By processing information and using strategic processing the child is able to monitor their own reading and develop self-management. According to Clay (1991), the successful reader is one who gradually acquires control in working with print (inner strategic control), is an independent reader, and is getting better at reading. Development, she claims, is characterised by more responses, finer discriminations, and greater flexibility.

Children use a variety of reading strategies to monitor their own reading (Clay,1991). They use meaning to control what they are doing. They draw upon this and the language competences (skills and knowledge) they have. They detect errors and then decide what they should do to correct errors (metacognitive skills). These processes are further refined and enriched as the child uses new strategies. As well as items of knowledge the child has learned strategies for working with information about print. The child has ways of finding it, storing it, filing it, retrieving it, linking and cross-referencing one kind of information with another. Hence the child uses many cognitive and metacognitive strategies.

Since a teacher is unable to observe what children are actually learning, how then can they build up a useful model of children's problem-solving activities when reading? According to Clay (1991), this can be achieved through `observations' of overt reading behaviours. We can observe how well the child

works on print, what kinds of cueing are used (semantic or syntactic meaning, grapho-phonics and pictures) and what kinds of rules and relationships he is learning (between words and between print and sounds) .

In gaining control, according to Clay (1991), the child uses four sets of behaviours. They use their own language system for meaning (semantics) and for the structure of the language (syntactics). They visually attend to print. They hear the sounds in the sequence of language and they adopt directional behaviour as it relates to position and movement. Clay (1991), suggests the importance of `observing' children's reading behaviours over time in order to understand developmental aspects of their learning.

Hence a child learning to read, according to Clay (1991), learns to choose between alternatives. When listening to a child read, one senses he/she realises there is a solution that is a best fit and that there is one oral response that is equivalent to the text. The child therefore seems to be developing a need or a willingness to chose between possible alternatives and that they must work to discover a best-fitting response.

This process is aided by their increasing ability to cross-check; checking and trialing the range of possibilities available to them and choosing the most appropriate and meaningful option. Children frequently pause when reading, trying out loud or in their mind's eye options based on a variety of strategies, before applying the one they seem most happy with, that is, makes most sense to them. In doing this, children seem to be making discoveries about the written code, that is, concepts about print and letters of the alphabet. Children will sometimes stop during their reading and make comments about these to other children, teachers or other adults.

Children actively search for differences, and are able to identify similarities in words, as their discriminatory powers increase. For example, children often

stop to comment when they recognise a familiar word they have just met, or a word that starts the same way as another, or to point out similarities and differences between two words.

Children seem to pay more attention to a range of cues, eg. orthographic, phonemic, grammatical, semantic, instead of relying heavily on the use of mainly one kind of cue. Commonly picture, grammatical and semantic clues are added to by graphic and phonemic cues. As well, children are discovering new words and features of words, eg. letter analysis, syllabification and clusters, little words in bigger words, visual analysis by analogy and syntactic or semantic information.

Other factors to be taken into consideration when `observing' children's reading, according to Clay (1991), are the speed of reading, the accuracy (rate of self-correction), evidence of the level of processing through the various levels of text, sentence, word and letter, which self-correction strategies are used, how appropriate are their substitutions, how do they confirm their responses, what strategies they use for new words, the type of book being read and the level of difficulty, how quickly they master particular skills and the fluency and awareness of using new skills.

Children develop these skills at different rates and use a variety of cognitive processing strategies. It is the role of teachers, then, to become aware of the level and kinds of processing used by individual children in order that they may provide appropriate teaching strategies that will facilitate future growth, greater inner control and development towards independent reading.

In order to create conditions for purposeful assessment and evaluation most likely to contribute to effective teaching and learning, teachers need to encourage children to express their thinking, particularly through problem-solving activities. For it is through this process that children can reflect on

and reorganise their current ways of thinking. By providing an appropriate social climate in the class, children feel free to express their thinking, regardless of the `correctness' of their response. These learning opportunities are possible when teachers initiate and guide the negotiation of social norms for classroom activity. These include that children engage in taking the perspective of others, listen to and try to make sense of each other's solution methods, give explanations and question the explanations of others, and attempt to resolve conflicting points of view, especially when working in small groups. Children need to be aware that meaningful activity is valued over correct answers, that persistence on a personally challenging problem is more important than completing a large number of activities and that they are responsible to figure out solutions which are personally meaningful. Children therefore seek to develop a basis for collaborative activity (Barnes & Todd, 1977; Perret-Cleremont,1980; Bauersfeld, Krummheuer & Voigt,1988; Yackel, Cobb & Wood,1991). For learning is both an interactive and constructive activity. Hence reporting on children's progress should include an individual's ability to co-operate in small groups, their persistence when completing tasks, and their willingness to listen to the explanation of others.

The starting point for teaching, then, should be based on the individual child's ways of thinking and knowing. This means that teachers need to listen to children as they give explanations in small group problem-solving activities and by interacting with them as they give explanations and justifications in whole class discussions. For it is this kind of assessment that `empowers teachers to engage in dynamic instructional decision-making', with teaching and assessment operating simultaneously and being mutually dependent. This also contributes to teacher's continuing professional development (Yackel, Cobb & Wood, 1992).

As a result, students are able to attain higher levels of conceptual understanding, have stronger beliefs about the importance of understanding and collaborating, and attribute less importance to conforming to the solution methods of others, competitiveness, and extrinsic reasons for success (Cobb et al., 1991; Nicholls, Cobb, Wood, Yackel & Patashnick,1990; and Nicholls, Cobb, Yackel, Wood & Wheatley,1990).

In summary, teaching strategies which reflect a socio-constructivist perspective include planning, observation, analysis and assessment as ongoing interrelated activities which mutually inform each other. Children are capable of increasingly powerful constructions as teachers and fellow students interact through co-operative argumentation. It would appear that these strategies are effective in bringing about successful learning and thinking in a wide variety of local settings (Yackel, Cobb & Wood,1992).

8. EFFECTIVE TEACHING AND LEARNING STRATEGIES

Knowledge and understanding about thinking and learning and the teaching of these appears vast and complex. It therefore would be impossible to reduce the teaching of thinking and learning to simplistic, step-by-step lesson plans. However, it appears that thinking and learning can be taught as our knowledge and understanding of the cognitive processes and their relation to learning, motivation and performance increase. There appear to be many appropriate teaching strategies that are likely to enhance all students' learning, both in and outside formal school settings. These should assist all students to gain more content, learn more about learning, and think more about thinking, and increase their repertoire of skills and strategies in order to increase control over their learning.

Since we are concerned with cognitive processes, content needs to be selected because of its contribution to process (Costa,1992, p.3), therefore becoming a vehicle for thinking processes. Development of the intellect, learning to learn, knowledge production, metacognition, decision making, creativity and problem solving become the subject matter of instruction.

Inherent in teachers' choices of strategies to develop the intellect need to be those which contribute thoughtful learning, craftsmanship, metacognition, and rigour into the curriculum and teaching practice. Teachers' repertoires need to include a variety of teaching skills and strategies in order to develop a wide range of reasoning, creative and co-operative abilities in students. Knowledge

about teaching techniques and strategies are also required to make decisions on goals, students' characteristics and the context in which they are working. Teachers need to vary their lesson designs according to students' developmental levels, cognitive styles and modality preferences.

It is through teachers' understandings of where students `are at' in their thinking and learning, together with an appreciation of the differences in learning styles of students that will enable teachers to assist students to become more active, independent and effective learners and thinkers. If we know what outcomes are desired, and we have understandings of the different ways children think and learn, then we can more readily select or construct learning experiences that contribute to their acquisition, as well as determining what student behaviours indicate that those goals are being achieved.

What then are the dispositions, attitudes or inclinations that are characteristic of effective learners and thinkers, ie. intelligently behaving human beings? Not only are we interested in what students know, but also how they behave when they don't know. In what forms does intelligent behaviour occur when we are confronted with questions and problems for which we don't know the immediate answer? Successful learners and effective thinkers appear to share many identifiable characteristics, which have been identified previously in this document.

To recapitulate then, the many characteristics of intelligent behaviour, generally agreed upon by contemporary researchers, that teachers are likely to be able to teach and observe include - persistence, risk-taking, decreasing impulsivity, listening to others with understanding and empathy, co-operative thinking (social intelligence), flexibility and fluidity in thinking, higher-order thinking, metacognition (awareness of one's own thinking and

taking control of one's learning), a wide knowledge base, clear communication, questioning and problem posing, striving for accuracy and precision, a sense of humour, drawing on past knowledge and applying it to new situations, recognising patterns in information, using all the senses, having the ability to draw on the appropriate processing mode for the task at hand, creativity (ingenuity, originality, insightfulness), wonderment, inquisitiveness, curiosity and the enjoyment of problem-solving. This list is by no means complete, but indicative of commonly shared characteristics of effective learners and thinkers. Not only are these behaviours likely to be encouraged and developed through direct teaching practices, but indirectly through the provision of an appropriate classroom environment, as well as provision for individual differences in learning. From knowledge gained through this document, it can be seen that teaching and learning are inextricably linked and function in relation to each other.

Outlined here are some teaching strategies that contribute to intelligent behaviour and promote effective learning. They are also likely to contribute to the development of life-long learning skills. They are not necessarily able to be implemented as clear-cut procedures, but tend to be inter-related. For the purposes of this paper, they are examined and discussed separately, but need to be considered as integral parts of a whole teaching and learning approach.

8.1 Strategies for Using and Developing the Senses

The views on how individuals perceive and experience prior to the brain comprehending, have already been examined. It appears all information reaches the brain through our sensory channels - our tactile, visual, auditory gustatory, olfactory and kinaesthetic senses. In fact, it appears that language, culture and physical learning are all derived from our senses. Those whose

sensory pathways are open, alert and acute appear to absorb more information from the environment than those whose pathways are withered, immune and oblivious to sensory stimuli. The effectiveness of our sensory perceptions, therefore, appears to have a marked impact on our ability to remember. Just as we perceive through many modes, we remember in many modes as well.

It has also been examined how individuals have preferred modes of perceiving, as well as preferred modes of remembering. It is important that teachers provide learning experiences that cater for the differences in sensory modes used by children in remembering, eg. those based on sight, hearing, touch, taste, smell, feelings and acting out. Only when we experience first hand can we really know and hence remember.

It is also important that teachers provide a variety of sensory experiences to develop and sharpen those senses not readily available to the individual. Not only does this seem to assist in short-term memory, but promotes long-term memory. By increasing the number of the ways children experience, the number of pathways linking short-term and long-term memory are therefore likely to be increased and strengthened, thus allowing the integration of experience with previous experiences. When combined with deliberate reflection processes this is likely to contribute to powerful learning with meaning.

As children grow, we can observe them conceiving and expressing the many ways of solving problems through the use of their senses, eg. making observations, gathering data, experimenting, manipulating, scrutinising, identifying variables, interviewing, breaking problems down into components, visualising, role-playing, illustrating or model building. As teachers we need

to provide a variety of learning experiences in order to promote these kinds of activities.

As well as the senses, emotion seems to play a vital role in learning, in particular aesthetics. This appears to be very much part of the spirit of inquiry, inherent in creativity, and a prerequisite to discovery. Not only do learners need to be cognitively involved, but also enraptured with phenomena, principles and discrepancies they encounter in the environment. `In order for the brain to comprehend, the heart must first listen' (Costa, 1992).

Aesthetics used here means sensitivity to the artistic features of the environment and the qualities of experience that evoke feelings in individuals. Such feelings might include enjoyment, awe, sadness, and exhilaration. Hence, aesthetics is the sensitive beginning of rational thought, which leads to understanding and enlightenment about the complexities of our environment. Aesthetics may be the basis of scientific inquiry; the source of such skills as observing, investigating and questioning. It may also play a vital role in sustaining motivation, interest and enthusiasm. `With the addition of aesthetics, cognition shifts from a mere passive comprehension to a tenacious quest' (Costa, 1992).

How then can teachers nurture these aesthetic qualities in children? It would appear that children need many opportunities to generate an awareness of and commune with the world around them as well as a time to wonder, that is, to be amazed and charmed by the appearance of a new shoot or the opening of a flower, to find beauty in the clouds or grandeur in the shape of a mountain, marvel at the various colours of the trees, intrigue in the geometry of a spider's web or the logical simplicity of mathematical order. It is hoped that the environment will attract their inquiry as their senses capture the

rhythm, patterns, shapes, colours and harmonies of the universe. It is also hoped that children will not only display cognitive behaviours but also compassion towards other life forms as they appreciate the need to protect their environment, as well as respecting the roles and values of other humans. It is also hoped that they will perceive the delicate worth, uniqueness and relationships of everyone and everything they encounter. Following inspiration comes exploration and investigation as children ask `What?' `How?' `Why?' and `What if?'

Therefore helping children to develop their senses and being more aware of their own emotions and the differing emotions of others, through a variety of learning experiences in the classroom, will help foster richer thinking and learning. It appears that teachers who approach thinking with an aesthetic sense may be the inspiration for children to become keen observers and insatiable questioners, as well as encouraging their compassionate attitude to the environment and a life-long curiosity; all important prerequisites for higher-level thought.

8.2 Strategies for Whole-Brain (Multi-modal) Processing

As examined earlier in this document, contemporary studies by researchers, including Ornstein (1986), Hermann (1989) and Biggs & Collis (1991), have led to new understandings about the ways the brain processes information, hence our different ways of knowing the world, our different ways of responding to the world. Evidence from these suggests the importance of individuals using many processing modes for effective thinking and learning. Our knowledge of these helps to inform our choice of teaching strategies that identify and develop all these modes in individuals in order to achieve more meaningful learning.

To recapitulate, Biggs and Collis (1991) suggest that in order to encourage optimum learning, there is a need to cultivate many modes of thinking which help to increase the variety of strategies a learner has at his disposal for problem-solving. Ornstein's `left' and `right brain' processing suggests that individuals have two main processing modes, logical/analytical and holistic/intuitive modes. Hence individuals using `left brain' thinking tend to be concerned with words, numbers, parts sequential and linear order. Individuals using `right brain' thinking, on the other hand, are mainly concerned with images, patterns, wholes, and connections. .

Refining this further, and also examined earlier, is Hermann's Whole-Brain Model (1989) in Figure1 (Appendices). Hermann suggests that there are 4 different modes of thinking, that is, 4 ways that individuals process information when they learn - we feel, we intuit, we analyse and we act - all modes, he claims, necessary for effective learning with meaning. Hence he suggests that individuals show different brain dominance patterns, with preferred processing modes. Individuals showing dominance in the Upper Left Brain tend to be factual, logical, analytical and quantitative, often using convergent thinking and generally ask `What?' and want to `know that'. They often like working alone. Dominance in the Lower Left Brain results in planned, organised, sequential and detailed learning with the individual wishing to know `How?' and wanting to act and do. They tend to work well with others. Individuals with dominance in the Upper Right Brain tend to be creative and artistic, intuitive, spatially aware, use divergent thinking to synthesise and integrate and show strong visual tendencies. They favour learning alone, through self-discovery, often asking `What if?' Individuals with dominance in the Lower Right Brain tend to learn through strong emotional and kinaesthetic tendencies. They tend to express their feelings and ideas freely with others. They often ask `Why?' However, this does not mean that

individuals only process in one mode, nor are incapable of developing other processing modes.

The significance of this for teaching is four-fold. Firstly, teachers need to use strategies designed to access deliberately all four modes of thinking in order to reach all learning styles, and hence facilitate learning. Secondly, teachers need to help students recognise their dominant processing mode and bring about an awareness of all four processing modes. Thirdly, for successful learning, students need to be able to draw upon the appropriate processing mode for the particular task, eg. logical, analytical, fact based thinking may be an appropriate mode to employ when engaged in a debate or writing a report. However, when writing to capture and express an emotion, emotional and experiential thinking needs to be employed. Teachers need to engage the learner in the appropriate thinking mode(s) for the task. Fourthly, and probably most significant, is that students need to engage in whole brain processing for most effective learning. According to Atkin's model of Integral Learning in Figure 2 (Appendices), the process of learning progresses in a particular way. It moves from experience, to reflection on experience so that a pattern or framework allows the learner to grasp the meaning in the `mind's eye'. Finally, learning moves on to a facility to use language, rules, laws, and principles for accuracy and efficiency in thinking, doing and further learning; the language being a symbol for what's grasped in the mind's eye which in turn is a mental representation of what has been experienced. The extent of new learning therefore depends on past experience. Hence, according to Atkin (1993), teachers need to provide learning experiences which allow for the integration of experiences, feelings, reflections and actions. It appears that it is through this whole brain kind of learning that effective learners are able to internalise what they have learned and able to transfer their learning to new situations. For example, when faced with new information presented

in A quadrant mode (Figure 1), according to Atkin, they might ask, `What is that like?' `What is an analogy/image/pattern that applies?' `What is an example of this?' `How does this relate to other examples/situations I've experienced?' `Now let me see. . . ' so using representations in D, B and C quadrants (Figure 1). For them the model of integral learning is reversed.

Teaching and learning strategies that support this whole brain learning model through engagement in different processing modes are represented in Atkin's map (Figure 3, Appendices). They include a wide range of strategies including graphic representation in many forms, guided visualisation, the application of rules, formulae and definitions, step-by-step methods, lists, analogy, brainstorming, role play, drama, story, discussion, music, hands-on experiencing, and mind mapping. The major implications for teaching using this model are as follows. Learning experiences need to be designed to engage personal relevance. Reflection processes which assist the learner to make connections and develop patterns and relationships need to be developed along with the language and symbols used to represent them. Learners need to be provided with opportunities to express their learning in a variety of modes, as well actively try out their `mental maps' in their own world. It appears that through the deliberate use of all these strategies our different ways of knowing will be stimulated, and hence increase the potential for effective, meaningful learning.

8.3 Strategies that Facilitate Drawing on Past Knowledge and Applying It to New Situations.

As has been mentioned previously, students need to be able to abstract meaning from past experiences and apply it to new situations in order to facilitate meaningful learning. If they are unable to transfer processes, then they are not thinking, merely relying on memory or habit. As discussed

earlier, if students are to be successful learners throughout their life, they need to be able to apply their school-based knowledge to real-life situations and content areas beyond those experiences in the classroom. It is therefore the responsibility of teachers to enable students to mobilise their past knowledge and experience in ways that will enable them to face new challenges and to attack novel problems confidently, rationally and productively. This process will be enhanced as students develop a wide range of experiences, an extensive knowledge base, and a wide range of thinking skills and strategies.

As we have seen, our current view of knowledge and its acquisition in terms of constructivism suggests that individuals are continually reinterpreting their world. Rather than viewing knowledge as separate entities in the brain which have been passively received from the environment, it is viewed as a network of concepts and constructs which the individual actively constructs. Learning therefore is the making of connections between new information and the learners network of knowledge which enable increasing complexity or sophistication of a concept.

Teachers, then, can assist this process by providing learning and problem solving experiences where children are actively discovering, experimenting, questioning and challenging their current knowledge. This may be facilitated as children engage fully in the exploration of materials, concepts, ideas and feelings through imagining, creating, discriminating and hypothesis testing. To help children make new connections, teachers need to be asking questions and stimulating the asking of appropriate questions by the learners themselves, as well as assisting the learner to answer those questions for themselves. Teachers need to be aware of the learner's previous knowledge and developmental level in order to a provide appropriate assistance. Rather than waiting for a child's readiness to learn, teachers need to discover the

child's actual level of development and offer support which will facilitate the development to a more advanced or sophisticated level. This support could be through adult guidance or through collaboration with more capable peers. Having given support in tackling difficult situations, children are then more likely to be able to independently practice and consolidate this new learning before attempting more complex tasks. Teachers need to be constantly aware that some children can cope with a greater distance between new and old learnings than others. As mentioned previously, the means by which children can be supported in learning how to learn and in moving from one level to the next is often referred to as scaffolding.

Through scaffolding, children may be helped to learn general approaches to problem solving, specific strategies for specific tasks, and ways of monitoring their thinking. Through scaffolded tasks, teachers are able to model thinking strategies. This facilitates control of the learning situation to gradually pass from the teacher to the child as actions become internalised and ways of thinking are learnt in a social context. A sensitivity to the level of help needed determines the degree and nature of assistance given by the teacher.

Distancing strategies appear to be another way of assisting the development of representational competence. As previously seen (Copple et al, 1984; Connell, 1987), these strategies help children to disembed their thinking, that is, deal with experiences (objects, events, actions) separate in time from the immediate present. The child is then more able to differentiate, integrate or re-integrate experience. Teachers can facilitate the development of these strategies by helping children to assess alternatives, anticipate the future and reconstruct the past, thereby promoting more flexible thinking.

It appears that distancing strategies can vary in level, form and content. Low-level distancing strategies, such as labelling an object, producing information,

describing, demonstrating or observing, make minimal demands on a child's cognitive ability. More advanced distancing strategies, such as classifying or sequencing objects, or finding similarities or differences are more demanding. Most demanding, and being most effective in enhancing representational competence are high-level distancing strategies. These include asking children to discover relationships between events - cause and effect, and being able to generalise, plan, and propose alternatives to resolve conflict.

According to Sigel (1994), teaching that enhances representational competence will take three main forms. Firstly it will place the cognitive demand on the child, through the use of thoughtful questioning. Secondly, it will draw the child's attention to a discrepancy, contradiction, or inconsistency. The resolution of this will most likely result in a new integration of ideas. Thirdly, teachers need to involve the child in mental activity that requires going beyond the obvious concrete event.

Another way of increasing children's ability to organise and represent thoughts appears to be through the use of concept maps. These are also known as semantic webs, mind maps and graphic organisers. They can be used to represent what the learner knows about the links and relationships between concepts. They also seem to be useful in activating and retrieving prior knowledge and relating it to recently acquired knowledge, therefore assisting learners to make new connections between past and new knowledge. Teachers can model concept mapping and construct class maps together before using them on a group or individual basis.

Connectedness also seems to depend on the different ways children learn. Learning appears to be enhanced by the learner constructing and representing meaning in a number of different ways. Therefore the learner who is able to function in a range of modes, appears to have access to a wide

variety of strategies for problem solving. Strategies that foster multi-modal functioning, as previously suggested, need therefore to be part of the teacher's repertoire.

It seems that through children actively being involved in their learning, through first-hand experiences, through questioning and problem solving, through teachers' scaffolding of children's learning, and through multi-modal processing, they are constantly making connections between old and new information. This appears to facilitate children's ability to abstract meaning from their experiences and apply it to new situations. Students who are developing this ability may be heard to say, `This reminds me of .... ' or `This is just like the time when I . . . .' . They explain what they are doing by using analogies, and references to previous experiences. They are able to draw on their bank of knowledge and experiences as sources of information to support, theories to explain, or processes to solve each new challenge, thus increasing the effectiveness of their learning.

8.4 Strategies that Promote Language, Communication, and Co-operative Thinking

We have already learned how recent evidence suggests that language is the means by which learners make sense of the world. We have also seen how learners seem able to advance their knowledge and understanding of the world through increased language competence, enabling more abstract conceptualisation. The implications of this for teaching are that children will best grapple with meaning if they are first allowed to deal with familiar sounds of spoken language and gradually be introduced to other literacy forms as their confidence and competence grows. Teachers need therefore to provide adequate `conversational space' and opportunities for enquiry. It is likely that this will facilitate more disembedded thinking. Making children ready to learn

is helped by finding ways of representing features in problem solving situations so they are more manageable in the mind. It seems that even young children have the ability to reason and solve problems as long as the language used is embedded in a familiar context. This appears to apply to learning in all subject areas.

Learning to read it seems, from evidence in a previous chapter, seems also to be another important component of intellectual development, since the child finds themselves in a situation where they must direct their thinking in one way rather than another, in order to make meaning. By stopping to consider possibilities, children are becoming aware of their own thinking. The lasting character of print means there is time to stop and think and consider possibilities. We can infer that the very features of the written word which encourages awareness of language may also encourage awareness of one's own thinking and be relevant to the development of intellectual self-control. It also seems likely that the mastery of complex reading skills could significantly contribute to the intellectual growth in general.

Language then, appears to make a major contribution to the development of thinking. Teachers need to be aware of individual differences in grammatical, syntactical, phonological, and discourse knowledge of children, since these affect the oral, written, expressive and reading processes. Unless children develop skills in these aspects of language development, they will tend to remain passive, unable to construct or answer questions. It is the role of teachers then to provide opportunities for children to learn to reason in a meaningful context, and to encourage self-awareness thus increasing control of their own learning.

Also important in the development of thinking appears to be the need for a particular kind of classroom talk. If we are to encourage children to become

independent learners and questioners of the status quo, then we need to help them to think better, to be reflective and enable them to improve their performance. It appears that through critical enquiry students can help each other to reach new understandings through the use of dialogue and debate.

As has been previously mentioned, this is facilitated through setting up a community of enquiry in the classroom where children act co-operatively in the search for understanding. Children come to realise that working together is more powerful than working alone. Not only does each member benefit from the ideas and experience of everyone else, but each person feels valued as part of the whole community. There is constant feedback going on, with disagreements among the group being dealt with in an atmosphere of trust, mutual respect and a commitment to learn from one another. These differences are acknowledged as part of the continuing dialogue between positions, seeking increased understanding as an outcome. Students learn to follow the various lines of reasoning as the discussion takes place. These include sizing up assumptions that underlie each utterance, drawing inferences, testing for consistency, and learning to think independently by freely choosing one's own premise. Critical thinking is fostered as participants utilise the rules of reason as criteria for distinguishing between better and worse thinking; being dialogical, argumentative and dialectical in nature. This gives support to the idea of thinking and learning as a social and cultural process.

What then do teachers need to do to encourage critical enquiry? They need to provide regular opportunities for discussion of wide-ranging issues and ideas. They need to ensure that all voices are heard and considered equal. This involves the ability to listen to others and to `see' things from other people's point of view without being judgemental. Students then need to be encouraged to build on the ideas and feelings of others. In their efforts at

problem-solving and consensus seeking, students gain experience in expressing multiple perspectives, perceiving and resolving discrepancies and weighing alternatives together. The teachers role is one of mediator of the discussion; keeping the reasoning process going, orienting the discussion forward, drip feeding rationality into the debate, keeping the communicative cycle open and maintaining intellectual collaboration betweeen all learners. Teachers also need to allow children to work in groups on genuinely collaborative projects so that peer-group talk has a high profile. Children also need to be encouraged to ask questions which they see as relevant to the topic. Teachers also need to model the procedures for critical enquiry, eg. consistency, careful listening, respect for other points of view, etc. Teachers also need to make students aware that they must accept responsibility for their own views and learn to think for themselves. Children therefore are helped to realise that meaning is ever-changing.

Critical enquiry, or seeking out multiple perspectives in the search for truth, forms the basis of philosophy courses for children. Specific thinking strategies are offered by Lipman, Sharp and Oscanyan (1980) and Lipman (1988) through their Philosophy for Children. Through co-operative and rigorous inquiry children's thinking and reasoning skills are increased and their self-esteem enhanced.

8.5 Strategies that Encourage Questioning and Problem Posing

In order for humans to solve problems, to make decisions and to process information effectively, it appears they need to be able to ask questions which reflect diverse and profound thinking. For it is through questioning that individuals reflect on and challenge their current understandings, which is likely to lead to changes in learning and thinking. Questioning helps to

extend thinking skills, clarify understandings, create new links between ideas, provide feedback on learning, enhance curiosity and provide challenges.

Teachers therefore need to initiate this process by asking questions and posing problems. Through constant modelling and practice, a shift should then occur towards the students' asking questions and posing problems for themselves. It seems questions need to be directed, firstly, at developing lower-order thinking skills, especially for younger and less confident learners, and then extended to develop higher-order thinking skills, keeping in mind that young learners are capable of higher-order thinking. The types of questions asked then should change and become more specific and profound. Competent questioners are able to ask for data to support others' conclusions and assumptions, using such questions as `What evidence do you have?' or `How do you know that's true?' They also pose more hypothetical problems characterised by `if' questions : `What do you think would happen if . . .?' or `If that is true, then what might happen if . . . ?' They also are alert to, and recognise discrepancies and phenomena in their environment and inquire about their causes: `Why do bees buzz?' `How high can trees grow?' `Why do people have different coloured eyes?' `What would happen if we put saltwater fish in a freshwater aquarium?' `What are some possible solutions to littering in our school ground?'

What constitutes a good question and how many different kinds are there? Good questions, it seems, contribute to learning by sparking further questions and interest in seeking answers, by involving analytical, critical and creative thinking, and by going beyond the recall of basic facts. They also provide challenges without being too threatening. They are appropriate to the learner and the learning situation. They build on prior knowledge and make connections, and they involve students in reflection and planning.

It seems that different questions can be used for different purposes. Closed questions elicit only one correct response and are used to recall information and to assess prior and post activity knowledge of students. eg. `Who is the Prime Minister of Australia?' or `What does 4 + 1 = ?'. On the other hand, open questions can have many different responses, depending on prior knowledge and experience. They are used to build up information, allowing for more personal responses. They also generate further discussion and questioning. As well they can often lead to unexpected discussions and investigations, eg. `What are all the things a good speller might do?' `What are all the equations you can think of that equal 5?' `What shapes can be made using 5 lines?' Open-ended questions might begin with words such as `Give 3 reasons why. . . . ?' `Explain why . . .?' `Why do you think . . . .?' `Why do you believe . . . . ?' `In what ways are ____ and ____ alike?' `Predict what would happen if . . ?' `What if ..... ?' or `How can I get. . . . ?' Children's thinking may also be extended by providing them with an answer, and asking them to form a question, eg. `The answer is peanut butter. What could the question be?'

Questions can be used depending on the level of thinking required. For example, teachers can use the framework devised by Bloom (1976) to set questions that extend children's thinking (Figure 4, Appendices). Bloom suggests that children need to become competent in the lower-order thinking skills before moving onto higher-order skills. Teachers and children may work together on devising questions related to each aspect of thinking, and later children may devise their own questions in group or individual investigations.

Children need to become aware of the different ways of knowing, as previously mentioned. These can also be investigated as analytical, critical and creative thinking skills, to which appropriate questioning strategies may be developed.

Students also need to be able to self-question, in order to promote higher level thinking skills. A useful framework is set out in Figure 5 (Appendices). This model can be applied to a number of learning contexts.

The question matrix, Figure 6 (Appendices), is a visual prompt for helping students ask themselves better questions. The use of what, where, which, who, why and how questions can be linked with the present, past, possibility, the probability, predictions and imagination to help students ask and answer their own questions about a topic.

Questioning and problem posing can therefore be developed in a number of different learning contexts, and for a variety of purposes. Teachers initiate questioning and problem posing, but after practice encourage students to take on their own. Teachers need to be constantly aware of individual differences in thinking, hence provide appropriate questioning appropriate to the level of thinking. Questions need to be challenging, but not threatening. Through questioning and problem posing, students are able to increase the sophistication and complexity of their own thinking and become increasingly more independent learners.

8.6 Strategies that Develop Thinking Skills and Problem-solving Strategies

Thinking skills, considered to be the `core' thinking skills, have already been identified and include such skills as focusing, information gathering, remembering, organising, analysing, generating, integrating, and evaluating (See Chapter on Developing Thinking Skills). Some of these skills and related knowledge are context and task specific, relating to the learning of basic skills in particular subject areas, eg. directional movement and sounding in reading, carrying out addition sums or division in maths. Others are more general thinking skills and strategies, concerned with different ways of knowing, that are transferable across many subject areas or contexts. It is

generally accepted that effective thinkers and learners have well-developed general thinking skills and strategies, and it appears these are enhanced by the possession of many basic/specific skills. It appears that general thinking skills and strategies can be taught, and that programs specifically designed to introduce these are beneficial and promote their ongoing application in all areas of the curriculum. By directly teaching thinking strategies, students come to know about the sequence of steps to follow in each strategy, are able to ask better questions about information and become more aware of the appropriate strategy to use when processing information.

Among these are De Bono's Six Hat Thinking (1985) in which different coloured hats are used to represent different ways of thinking about a topic. These include looking for information, feelings, strengths and weaknesses, new ideas and thinking about thinking. Questions can be generated for each of these, relating to topics familiar to children, in everyday situations. Figure 7 (Appendices) shows the types of questions that could be posed about `School Holidays'. De Bono, in his CoRT Thinking (1976) promotes exercises in thinking skills such as Pluses, Minuses and Interesting Facts; Consequences and Sequels; Alternatives, Possibilities and Choices and Other People's Views.

We have already examined Bloom's Taxonomy of Levels of Thinking (1976) in which he suggests that children need to be proficient at the lower-order thinking skills of gaining knowledge, comprehension and application (observing, inferring, ordering and classifying) before attempting the higher-order skills of analysis, synthesis and evaluation (predicting, hypothesising, theorising). A variety of strategies can be created for thinking at each level, including teachers asking questions and teaching students how to ask better questions as they study information.

Remembering facts or information is generally considered the lowest level of thinking. To remember, one needs to be able to do such things as name, list, identify, define, describe, or label information. A major thinking strategy to help one remember is called mnemonics. Examples of these may include acronyms, acrostics, paired associates and points on a path (Langrehr,1993a). The next higher level of thinking is concerned with understanding information. Helpful strategies that enable us to comprehend information may include graphic organisers, generalising and summarising. Graphic organisers appear effective since the human brain appears to have a greater capacity to recall pictures and patterns than words or numbers. The next higher level of thinking is concerned with applying information. It appears that this is facilitated by using a problem solving strategy with metacognition.

Higher order thinking is developed by being able to think analytically, creatively and critically. Teachers can devise a variety of strategies to promote the use of these. Strategies that promote analytical thinking include those that enable individuals to see relationships between concepts and differences between such things as cause and effect, fact and opinion and definite and indefinite conclusions. Langrehr (1993) suggests a variety of thinking strategies which support the development of these. Thinking creatively includes the ability to look for and make unexpected connections between concepts through questioning. Skills and strategies that promote this kind of thinking include generating new ideas, taking different approaches, finding and considering alternatives, exploring available options, and challenging assumptions. The Victorian Ministry of Education (1986, p. 40) has listed seven types of questions that promote creative thinking to produce several possible answers or solutions. They are called quantity, change, prediction, point of view, personal involvement, comparative association and

valuing questions. Figure 8 (Appendices) shows how these questions have been used in a literature focus and a social studies investigation.

Strategies that develop critical thinking involve students making judgements with the use of relevant criteria, about such things as the relevance, reliability and bias of information Skills to be developed include the ability to examine, clarify, organise, reason, analyse, generalise, hypothesise, predict, assess, evaluate and synthesise. Strategies need to be implemented that help individuals understand the points of views of others. It appears from research evidence that a powerful critical thinker needs to be objective, open-minded, flexible, intellectually honest and curious.

Students can also be taught general strategies in dealing with problems. Problem solving involves the application of rules, principles, formulae, laws, and theories to a new situation. It runs through all levels of thinking. Teachers need to work with children to model these approaches, which can then be used in practical situations or in reasoning about hypothetical situations. The procedure may follow the sequence:

1.Understand the problem.

2.Decide on the goal.

3.Develop a plan to reach the goal.

4.Try the plan.

5.If unsuccessful, ask 'Why?', then develop another plan.

6.Evaluate success.

This follows the model for self-questioning in Figure 5 in the previous section.

It would seem then, that teachers need to provide problem-solving experiences in all aspects of learning as part of the day-to-day- learning process. Teachers need to allow children to explore, investigate, hypothesise, and then make conjectures about what this might mean. In the class their needs to be ample time for discussion, planning, carrying out the task investigation or experiment, time for rejection of results, and time to report findings to their class where appropriate.

Strategies for developing different ways of thinking need to be modelled by teachers, giving students many opportunities to practice these. As students become more familiar and confident with using these, they can then use these themselves when processing information in various ways. Langrehr (1993c) has a checklist of questions that good thinkers ask themselves when thinking in various ways (Figure 9, Appendices).

It appears that children become more aware of the different ways of thinking if they are taught in separate thinking courses, using meaningful contexts. However, as familiarity with them increases they need to be used in all areas of the curriculum. When thinking skills are taught in a variety of subject-orientated learning situations, it is generally felt they become more transfer able from one context to another and are more likely to be transferred into everyday learning situations. Learners need to be taught to approach tasks systematically by considering the nature of the problem, what they know, what they need to know and how they can approach the task. It seems the integration of subjects is more likely to allow transfer of these thinking strategies as well. It seems also that a good knowledge base and specific, basic skills support more general strategic thinking skills. Younger and less confident thinkers and learners need to master lower order thinking skills before moving onto higher order skills though it needs to be remembered that young children are capable of higher order thinking. This can be best

encouraged through teachers' guidance in informal settings with meaningful contexts.

8.7 Strategies that Improve Motivation and Self-esteem and Promote Persistence, Risk-taking and Curiosity

From evidence in this document, it appears that the ability to succeed in novel learning and problem-solving situations is not only the result of cognitive factors, but also of those related to attitude, personality, and behavioural characteristics. Children's learning potential may be increased through their awareness of these factors.

In order to raise the self-esteem of students, teachers need to explicitly teach them to recognise that the reason for failure is due to many factors, and not just a lack of innate ability, therefore beyond their control. Children need to be aware that these factors may include mood, fatigue, lack of background knowledge, unproductive effort and poor task analysis. Students need to be taught not be afraid of failure, but rather to see failure as a positive step through analysing each failure outcome and therefore profiting from the experience and aiding future experiences. They learn how to become risk-takers, and not fear whether they are correct or right. In fact the emphasis needs to change from thinking in terms of failure, to students thinking about an outcome as `Not the desired outcome ____ so keep going'. Rather than `trial and error', students need to see problem solving as `trial and improvement', whereby they are prepared to change their approach until the desired outcome is achieved. This is likely to lead to more confident problem solving. In fact creative people are often said to `live on the edge of their competence' (Costa,1992). They accept confusion, uncertainty and the higher risks of failure as part of the process and learn to view failure as normal, interesting and challenging.

Students also need to be taught that personal effectiveness depends on the use of appropriate strategies, not just being told to `try hard' or to `try again', without providing insight into the strategy most appropriate for the task. Task persistence is more likely to improve if teachers explain to students what it was about the unsuccessful strategy that led to the student's lack of success. Through using this strategy, improvements are likely to become generalised.

By encouraging students to monitor their learning performance, teachers will foster more effective learning in their students. This comes about as students develop the use of alternative strategies for problem solving. If after selecting what they think at first to be an appropriate strategy doesn't work, then they should know how to try another. Rather than giving up easily, students need to have systematic methods of analysing a problem, knowing ways to begin, knowing what steps need to be performed and what data needs to be collected.

It is important that teachers provide students with tasks appropriate to their developmental and interest level, as success is all important. For younger and less able students, this may require the performing of simple tasks where there are only a limited number of steps with opportunity for practice. Practice on task-specific strategies is acknowledged as important for improved performance. By providing classroom conditions that are non threatening, where children take part in co-operative learning and have adequate time for experimenting and reflecting, effective learning is likely. However, teachers need to be aware of the different processing abilities of students and provide appropriate challenges to extend more able students with more complex tasks, so as to avoid lack of interest and passive behaviour. Other ways to help improve skills and increase motivation is to train students to set realistic goals and administer self-rewards.

Along with self-confidence and more control over their learning experiences, student's curiosity about the world needs to encouraged. With opportunities to actively sense and wonder about the world around them their learning is likely to move from an `I can' attitude, towards an `I enjoy' feeling. Hopefully, they will be able to approach problem situations with confidence as well as seeking their own problems to solve.

8.8 Strategies to Develop Metacognitive Thinking

Metacognition, as already examined, is concerned with thinking about thinking. It involves the conscious regulation of our thinking, or executive control. Having the ability to control our own thinking forms the basis for decision-making and hence improving our performance and setting our own goals. Some children seem unaware of their thinking processes while they are thinking. When asked, `How are you solving that problem?' they may reply, `I don't know, I'm just doing it.' They seem unaware of how knowledge about the `self', the `task', and the `strategies' influences performance. Over time as children have more educational experience, they develop knowledge of their own thinking processes and strategies and their ability to monitor and regulate these processes. This requires the learner to analyse, reflect on and monitor their own learning. Teachers are able to assist this development by modelling the ways in which thinking can be assigned to a task, regulated and monitored. The sustained and repeated use of a variety of reflective strategies and skills incorporated within the context of purposeful learning experiences, enables learners to become aware of their usefulness and appropriateness in a range of problem-solving and real-life contexts. This is also assisted when teachers use strategies to help children raise awareness of, practice and assess their own reflective thinking processes. Developing skills and strategies in reflective and metacognitive thinking is considered to greatly enhance the students abilities to take responsibility for their own

learning. They are empowered by being aware of and being able to control their thinking. This is associated with increased motivation, willingness to take risks, enhanced self-esteem and independence. It is generally agreed that thinking skills assist our learning by helping us to access and make use of our knowledge. Metacognitive ability results in change which enables further growth and development.

Teachers need to be aware that the level of metacognition can vary. It seems that it is influenced by the person, the task and the context. It can vary due to a number of different factors including the degree of confidence with the task and oneself, experience with the task, the style of teaching and learning, the personality of the teacher/learner, motivational levels, the purpose of the task, available support, encouragement provided to take risks, the time allowed to reflect, practise and refine ideas and the support and feedback given. These are all important factors to be considered by teachers when assisting children to develop their metacognitive skills and strategies.

It appears that young children think reflectively before they come to school, although they may not be used to thinking about their own learning. They appear to use automatic processes to regulate their learning. They adjust their actions as they try out different methods in trial and error situations. Their lack of understanding about a new task or situation may be due to a number of factors including lack of background knowledge or experience, or not being able to identify or remember significant aspects of school learning tasks.

Students who are aware of and able to use their thinking skills to monitor and improve their own thinking and learning are being metacognitive, and hence are likely to be effective learners. They are able to make decisions, choose appropriate strategies/processes for a situation, self-assess, set their own

goals and act on their goals. Metacognitive thinkers seem to have access to a variety of useful thinking skills/strategies. These may be specific skills related to a particular task or more general skills used across the curriculum, including creative and critical thinking skills.

What do metacognitive students do? They are able to think reflectively. This involves assessing themselves and the situation, questioning and self-questioning, and linking ideas to previous/current and predicted experiences. It also involves thinking critically - examining, clarifying, organising, reasoning, analysing, generalising, hypothesising, predicting, assessing/evaluating and synthesising. They also think creatively - generating new ideas, finding and considering alternatives, are adaptable in their approach, explore available options and challenge assumptions. They then use this information about their own thinking and learning to make decisions, choose appropriate strategies/skills, self-assess (preferred style, strengths and weaknesses, etc.), set their own goals - action planning, and act on their own goals.

In other words, when faced with a problem or unfamiliar situation, they have an effective strategy-user plan to implement. As previously mentioned, they analyse the task, describing what information is missing and understanding the goal to be reached, `What do I know and what do I need to find out?' They then consider their range of strategies. `What plan of action will I take?' Their metacognitive knowledge allows them to choose an appropriate strategy, that is, which one is more effective than the others. They are able to list the steps and tell where they are in the sequence of a problem strategy. They then monitor their performance, `How well did I do?' If the strategy chosen is effective, they receive positive feedback celebrate their success. If not, they abandon the ineffective strategy and consider `How can I improve the situation?' or `What do I now know that I didn't know before?' which helps them to choose a more effective strategy, and work towards a more

successful solution. It appears that with extensive practice, and the provision of explicit feedback, children are able to choose effective strategies and objectively employ better ones. Their learning success is a combination of cognitive, metacognitive and motivational factors. They believe that their persistence and effort will result in success (they have control over their learning) leading to a healthy self-esteem and confidence to face new situations.

What then, are the teaching and learning strategies that will promote the awareness of children's thinking strategies/skills and allow them to use these strategies effectively to regulate their use - direct, plan, and monitor, in order to improve their own thinking and learning?

What seems to be required is a positive classroom community which encourages and reinforces independent learners and thinkers. The children actively participate in making decisions about their learning. The teachers and children work together to make decisions about what, when, and how to learn and why such learning is necessary. By making explicit the purposes behind educational experiences, students become aware of their own thinking processes. By negotiating and hence being involved in decisions, the children become more aware of their learning and of the conditions they require to become more effective learners. It also leads to a sense of ownership of routines and expectations of learning which in turn helps learners to develop a fuller commitment to their learning. Not only does negotiation assist in the development of reflective and metacognitive thinking, but also in problem solving, co-operation, goal-setting and time management (Wilson,J.& Wing Jan, L., 1993, p.56).

Negotiation can occur between the teacher and the whole class, in relation to expected class routines and behaviours. It can also occur between individual

students and the teacher when negotiating individual work requirements. It may also occur in small groups where roles within the group are being negotiated or tasks expected to be completed. Negotiations can also occur between teachers and parents on the content, processes and resources used in school programs.

Teachers retain responsibility for planning the broad understandings, concepts and skills that they expect students to develop, but the students may negotiate aspects of their learning such as the physical organisation of the classroom, the working conditions and certain aspects of their learning. The physical organisation of the room may include seating and furniture arrangements, storage of classroom resources and personal materials. Working conditions may include group membership, timetabling, classroom rules and procedures and the organisation of routines. Aspects of learning to be negotiated may include ways of structuring learning situations (group, individual, partner, peer tutoring, cross-age tutoring and learning centres), assessment tasks, contract conditions, ways of conducting, recording, presenting and assessing work, what is to he learnt (choice of topic), aspects of the topic that students would like to investigate and the setting of goals. Many of these can be decided in class meetings.

Within this positive classroom environment, student's awareness of their own thinking skills is likely to increase. Combined with regular and sustained modelling by the teacher of a variety of both thinking skills and strategies for appropriate tasks and situations, and the steps in strategic processing, students are able to see the value of this and transfer these to their own learning situations and problem-solving attempts. Students come to understand that personal effectiveness depends on the use of appropriate strategies. By encouraging students to monitor their learning performance, teachers are likely to foster more effective learning styles in their students.

As well there are other specific strategies for promoting a general awareness of reflective, metacognitive and motivational processes. Students need to be encouraged to keep `learning logs' or journals and diaries, in which they record their thoughts and feelings about particular learning/problem solving situations. Writing is seen as helping to develop and clarify thoughts. Students might write about points of confusion, generate questions for further clarification and self-study, and summarise insights gained from the experience. Younger children can use verbal sessions to discuss these.

Another technique widely encouraged in the modelling of reflective, metacognitive and motivational strategies is that of the `think aloud' technique. The teacher verbalises the thought processes and strategies they are using to tackle a specific problem solving situation. Students will have opportunities to see coping and repair strategies, understanding the importance of trial and error, risk-taking and persistence. They then can utilise these strategies in their own learning situations. They should also be learning to apply cognitive vocabulary correctly as they describe their thinking skills and strategies using phrases such as `I have a hypothesis. . . ', `My theory is . . . . ', `When I compare these points of view . . . ', `By way of summary . . . ', `What I need to know is . . . ' and `The assumptions that I am working on are . . . '.

Conscious monitoring to promote active learning on the part of the learner can be encouraged by children checking their own work, or even their peers if managed in a supportive way. Active monitoring can also be encouraged by teachers providing a variety of feedback opportunities for their students. Feedback aimed towards the processes of problem solving, rather than the product, should identify both successes and failures. Success needs to be based on task-appropriate strategies, where failure should provide feedback regarding task-inappropriate strategies. By making students reflect on the

relationship between task performance and strategic behaviour, learners are likely to choose more powerful strategies.

As well, teachers need to encourage a deliberate and systematic approach to learning. Students should be taught to approach problems systematically prior to, during and after problem-solving activities. It is considered critical that students have a clear sense of purpose of and reason for completing a particular task.

To encourage active participation in learning of less active learners, students may use self-directed verbalisations, or self-instruction, including self-questioning techniques. Teachers can model strategic use of self-questioning both to direct cognitive behaviour and to monitor progress toward goals.

Teachers can teach their students to cope with failure by making attributions about lack of effort with the correct strategy. By accepting failure as part of learning and showing children they can facilitate success with appropriate strategies, their self-esteem and confidence can be increased.

Individuals differ in their metacognitive abilities. Some children may lack confidence in their own metacognitive ability, even though they have well-developed cognitive abilities. A child with a lower cognitive ability may compensate by using metacognitive knowledge and strategies. Some children may lack particular experiences and knowledge that facilitate certain strategic processes. Some children may lack the ability to link past and present experiences. Some children may need much support through from teachers and peers for scaffolding, providing prompts to help children plan and evaluate their performance. Young children's metacognitive abilities appear to increase as they are able to consider multiple relationships when making decisions, are able to use the conventional symbols of their culture, consider multiple viewpoints, use higher level processes such as inferring,

predicting, hypothesising and reflecting in a more stable manner, and use strategies and plans for solving problems and remembering.

To summarise, then, teachers can assist children in thinking about thinking and learning in a number of ways. They can think aloud themselves, ask lots of questions and encourage self-questioning. They can encourage risk-taking and allow time for reflection. They can involve children in self-assessment and design programs that include a variety of thinking skills, problem-solving and co-operative learning. By establishing a positive classroom community that encourages active learning and independent behaviour, through managing and monitoring their own learning, teachers are preparing children for future learning in contexts outside the school.

Through the teaching and learning of a wide variety of cognitive and metacognitive strategies, including both specific and general adaptive strategies, including those mentioned throughout this section, within a language-rich, supportive classroom climate, children will become active, responsible, powerful and independent learners. Individuals who are able to challenge their existing thinking and current knowledge in a variety of ways using effective and appropriate processing strategies appear more likely to be able to take control of their learning and develop lifelong learning skills.

9. CONCLUSION

Through greater understandings of the unique needs and strengths of children, teachers can provide curriculum conditions that encourage both meaningful and successful learning. Central to children becoming successful learners and maximising their potential is the provision of learning experiences which help learners to increase control over their learning and help them develop new and more efficient skills, styles and strategies as they pursue learning goals. (Costa,1992; New & Mallory, 1994; Department of Education and The Arts, Tasmania,1991; Atkin, 1989,1993; Donaldson, 1978; Evans, 1991; Coles,1994; Hughes & Tizard, 1984; Langrehr, 1993; Cambourne, 1990; Pressley et al. 1987,1989.1990; Sigel, 1984; Clay, 1991; Bell & McCowan, 1992).

By being aware of the factors that individuals bring to the learning situation, including cognitive factors, their attitudes, their personality and behavioural competencies (Ashman & Conway, 1993; Pressley et al., 1990), and their language use ((Donaldson,1978; Hughes & Tizard, 1984; Clay, 1991), teachers are more likely to be able to engage the learner in worthwhile learning experiences. This will be supported further by teachers' considerations of other factors which affect development, including health, stress level, home and ethnic background, and gender and community expectations. For it is these individual learning factors combined with the social, emotional, physical and intellectual conditions provided by the teacher in the classroom that contribute to the learning experience.

Successful learning is also more likely where teachers select curriculum content on the basis of its contribution to process (Costa,1992). Development of the intellect, learning to learn, knowledge production, reflective thinking, metacognition, decision-making, problem posing and problem solving therefore become part of the subject matter of instruction. Teaching strategies which are chosen on the basis of contributing to thoughtful learning, craftsmanship, metacognition, and rigour are to be encouraged. Teachers' repertoires which include a variety of teaching skills and strategies that develop a wide range of reasoning, critical thinking, creative and co-operative abilities in students are also to be encouraged. Knowledge about teaching techniques and strategies will also assist in making decisions on goals, students' characteristics and the context in which they are working. Also essential to learning is the provision of meaningful contexts, having regard for students' developmental levels, cognitive styles and modality preferences. Extending students sensory experiences and their repertoire of processing modes will also promote more meaningful and more successful learning.

More specifically, curriculum conditions to be valued include modelling questioning and thinking strategies, giving constructive and positive feedback, encouraging interaction and group interdependence through respect for the opinions of others, encouraging risk taking and giving support in a non-threatening atmosphere, organising purposeful activities that have clear purposes and goals, having high, but realistic expectations by challenging students at an appropriate level of difficulty, providing choices, valuing and making time for the practical application of skills and strategies and also to reflect, share and assess (Wilson, J. & Wing Jan, L., 1993). Learning experiences which encourage a wide range of experiences are to be valued as well as desirable learning outcomes.

To further engage the learner and encourage their development towards becoming independent learners and thinkers, students are encouraged to participate in negotiating their learning experiences. Together, teachers and students can play a part in the organisation and assessment of their learning (Wilson, J. & Wing Jan, L., 1993).

Class communities are further enhanced and supported by whole school communities working together in an atmosphere of collegiality. Together administrators, teachers and parents can work at deepening understandings and making well founded decisions about future worthwhile learning experiences.

To what extent are teachers currently providing appropriate conditions of learning and teaching that will maximise the potential of all children to become successful learners? To what extent does current teaching practice reflect the basic beliefs and values of the socio-constructivist model of learning? It seems that, although teachers are aware of this model, it is not readily put into practice.

It appears that not all teachers share a common view of the child. If we believe that all children are potentially powerful, competent, responsible and independent (New & Mallory, 1994), then we should be searching for the underlying competencies in all children, rather than focusing on differences, deficits, or difficulties. Many teachers are still operating on the basis of the developmental stage model, believing that children have to pass through specified stages and attain competence in these before being offered more `advanced' kinds of learning opportunities. The socio-constructivist model supports learning communities comprised of diverse backgrounds, views and abilities as an effective means of extending and deepening children's

understandings. It also seems that not all teachers are really aware of the ability of young children for abstract reasoning and complex thinking.

As well a significant number of teachers and other adults, particularly those involved in early childhood and special education, see their role as carers and protectors of children (New & Mallory,1994). They have therefore tended to under-estimate the child's ability to be powerful, active thinkers and decision-makers, hence denying them the dignity of risk. The socio-constructivist image of the teacher as protagonist helps us perceive the value of being challenged, of making interesting mistakes, developing persistence, and of entering into a dialectical relationship with each other.

Teachers therefore need to place themselves in the position of the child to improve their own understanding of the child's abilities and behaviours. Through inclusion and an acceptance of developmental diversity teachers convey respect and confidence in each child's ability to succeed and to acknowledge the child's desire for interactive feedback when children share and compare their ideas whilst working in small groups or in class discussions. Children also come to respect and appreciate each other.

The significance of language in promoting cognitive development has been detailed. Language is far more than a subject in which children learn to read, write and spell. Language is a means by which new thoughts come into being (Donaldson, 1978; Coles, 1994). Spoken language enables us to communicate, to argue, to reason, to generate ideas, to express and choose opinions and to deepen understandings (Vygotsky, 1962; Donaldson, 1978; Coles, 1994; Hughes & Tizard, 1984; Clay, 1991). Children need to be given maximum opportunity for organised talk, especially in small co-operative groups. Much of teachers' talk is authoritative, rather than organising, collaborating, questioning and negotiating. Keeping control forms a major

part of some teacher talk. Many teachers still insist on quiet classrooms, seemingly underestimating the value of discussion. According to the socio-constructivist perspective, teachers need to encourage discussions and debate according to set guidelines.

The importance of teachers understanding the significance of children learning in a meaningful context has been outlined. Teachers are often unaware of the lived experiences of children, and the ways in which these can be incorporated into effective, engaging, and active learning experiences. Teachers often find it difficult to place themselves in the position of the child to help them understand what life is like from a child's perspective, to see where their views are coming from, and the ways in which they think and construct new understandings. It is an awareness of these factors that contribute to the provision of appropriate learning experiences that facilitate successful learning.

Some teachers are not confident of organising, implementing and evaluating classroom operations based on the socio-constructivist theory of learning (New & Mallory,1994). Some are not familiar with the essential steps in co-operative group learning with children of mixed abilities, of integrating subjects, of giving children ownership of their work and class, of the principles and practices of enquiry through discussion and debate and a general framework for carrying out problem-solving activities.

Some teachers' assessments of children's learning still emphasise the end product (Yackel, Cobb & Wood, 1992). Socio-constructivist theory highlights the importance of process as well as product, for it is through the process of learning that new understandings come into being. Written records of children's work, including their correct answers are not necessarily more valued than their trials, their attitudes, and dialogue with others. It is through

careful observation and feedback that indicate to the teacher the extent of the child's developing inner control (Rowe,1991; Yackel, Cobb & Wood, 1992). Hence teachers need to be aware of children's risk-taking, persistence, questioning, self-talk, and their ability to listen to and empathise with others.

It seems that not all teachers share the same views about what it is to be human. This may in part be due to the varying backgrounds of teachers and their views on children's needs. According to Van Manen (1991), to see a child is to see possibility, someone in the process of becoming. Learning, then, should enable the child to respond to their surroundings, and understand their relationship to it, regardless of their background, experiences, beliefs and attitudes that they bring to each learning situation. As well, we need to see children as social beings, as makers of their future, making active choices, showing commitment and responsibility to life both as individuals and as part of society. Past educational practices in schools have tried to bring all children to the same destination, whereas current practice strives to help children learn how to become who they are. In the interests of social justice and equal opportunity, teachers need to provide inclusive teaching practices and strategies, in order to minimise disadvantages that may result from differences in gender, culture, race, religion, socio-economic status, geographic isolation, and physical and mental attributes. The challenge for teachers, then, is to understand individual differences and use skills and strategies to develop these in a variety of ways to promote successful learning.

To increase the potential of all children to become successful learners and further develop their inner control (Clay, 1991), teachers need to become more familiar with and confident in practising teaching strategies based on the socio-constructivist view of learning. They need to understand that learning experiences need to be based on children's current ways of thinking, and of

the importance of children being aware of their own thinking in order to reflect, monitor and influence their own thinking. They also need to understand the importance of a co-operative, supportive, social and cultural context, the need for active learning and the need for all children to be able to use appropriately and effectively a variety of both specific and general adaptive processing strategies in novel situations.

In what ways might this be possible? There needs to be continuing opportunity for discussion among teachers of appropriate and effective teaching practices. Within schools, class teachers need to be given regular non-contact time to be able to talk together, to visit other schools and talk with other teachers, as well as having on-going professional development sessions where views and ideas can be shared. Teachers need support in trying teaching strategies that they might otherwise have been unsure of and not confident of attempting. It is also important that schools consist of teachers who are familiar with current learning theory, particularly new teaching graduates, and that those teachers who have been practising for a considerable time be given opportunities to up-date their knowledge of current `best' practice. It also seems apt that teachers practicing in schools should represent a cross-section of the community.

Whole schools, including teachers and parents, the general community and government bodies need to recognise the right of all children, regardless of their background, experience and level of development, in having equal opportunity to achieve effective educational outcomes, including the ability to think for themselves and continue to increase control over their learning. For it is in recognising these rights that children will be encouraged to become worthwhile, capable, responsible and independent members of society, and contribute to a future based on a morally higher social order. The ways

resources are used need to be changed, particularly human resources, in order to promote these objectives.

The possibility exists for all teachers to enhance the intellectual potential of all children by increasing the child's self-control and their ability to become independent learners. Through teachers reflecting on their own beliefs and values about children and teaching, and becoming more aware of those promoted through recent educational documents, appropriate conditions of learning are more likely to be provided. Teachers need encouragement and direction to change their teaching by way of sharing first-hand experiences with other teachers who are comfortable in practices promoted by the socio-constructivist perspective. These will then provide them with the confidence and skills to incorporate these into their own teaching practices.

It is in the provision of appropriate conditions of learning that children are likely to develop new and more efficient skills, styles and strategies that allow them to adapt to altered situations, tackle new tasks, make decisions, and solve new problems. It is these competences that are likely to enhance their ability to take responsibility for their own learning, and equip them with lifelong learning skills.

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APPENDICES

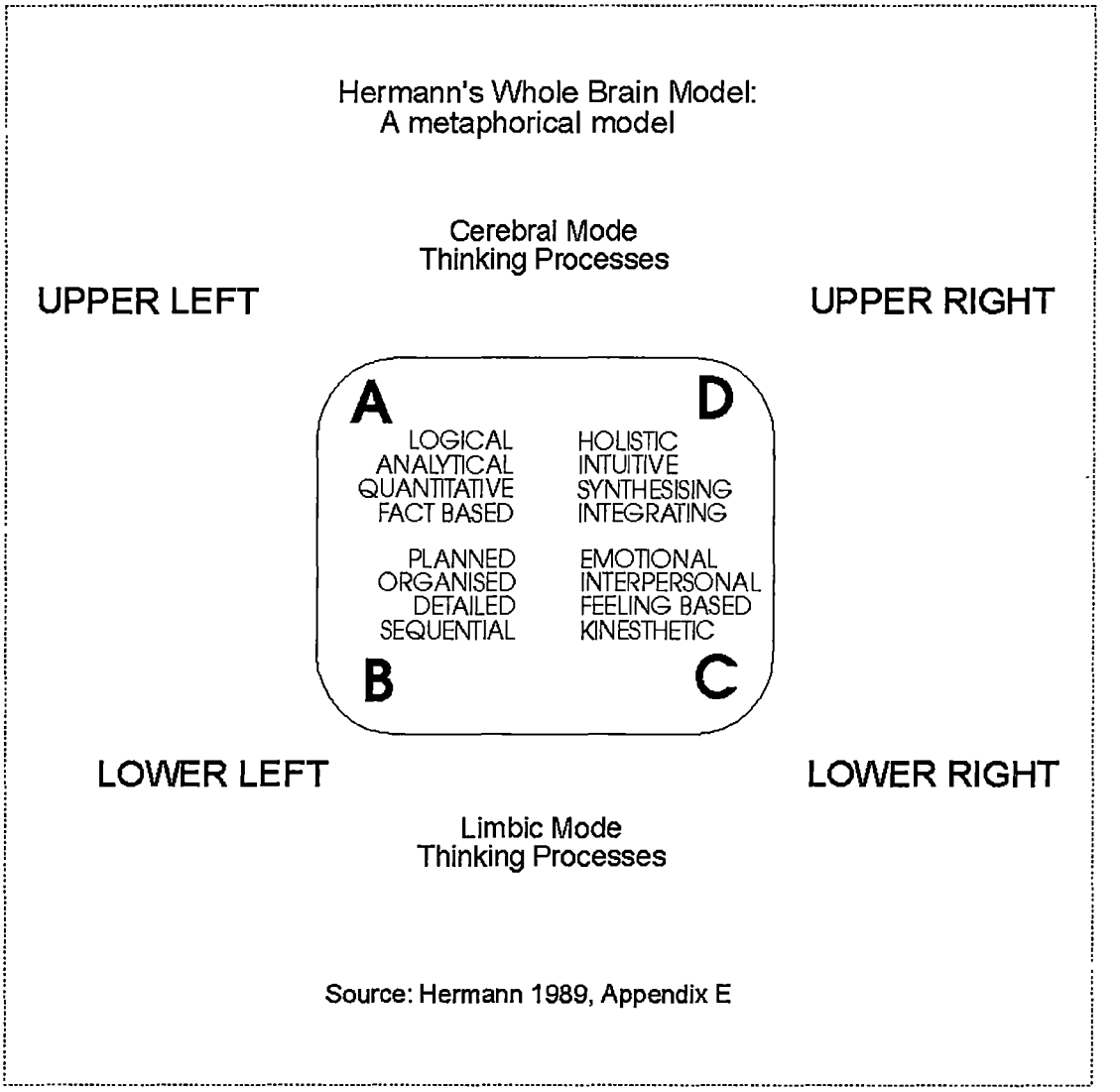

Figure 1.

Hermann's Whole Brain Model

Source: Atkin, 1993.

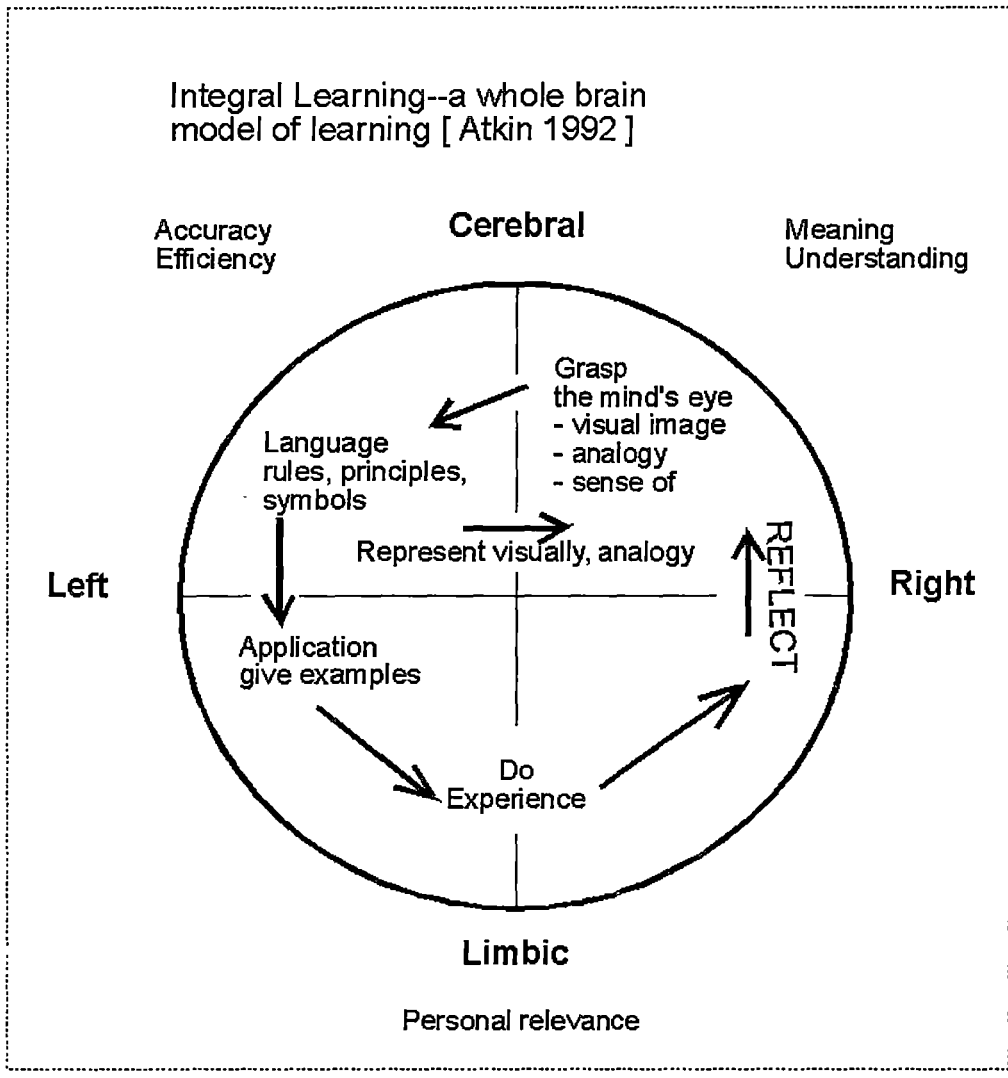

Figure 2.

Integral Learning

Source:Atkin, 1993.

Teaching/Learning Strategies to Engage Different Process Modes

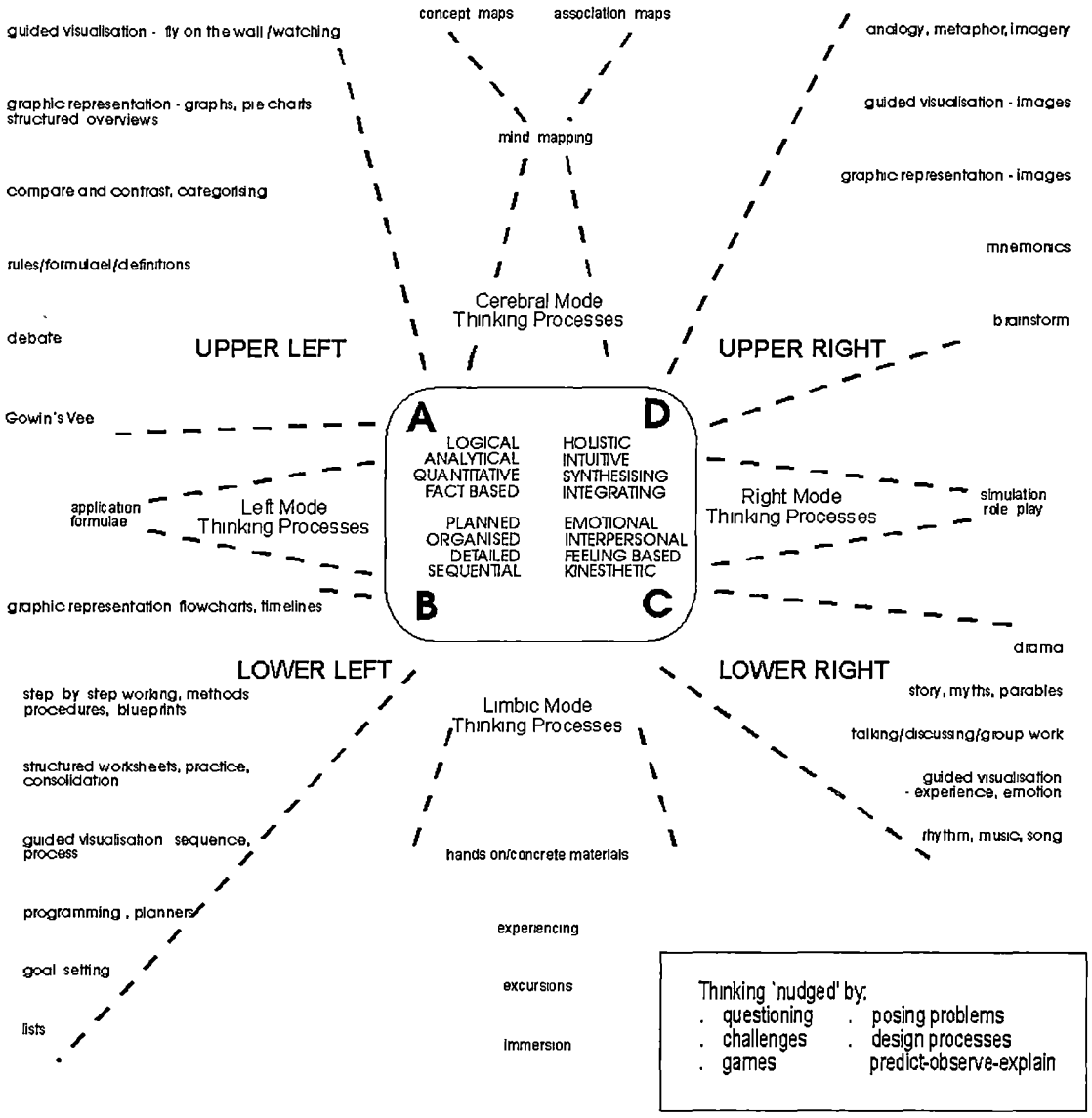

Figure 3.

Teaching and learning Strategies to Engage Different Processing Modes

Source:Atkin, 1993.

Bloom's Taxonomy of Cognitive Processes

Thinking processes	Meaning	Examples in:		
		Literature	Maths	Science
KNOWLEDGE	The recall of factual information	What are some of the things Goldilocks did in the house of The Three Bears?	What are the symbols used in the Roman numeral system?	What is a mammal?
COMPREHENSION	To show an understanding of information	Why do you think The Three Bears left their house unlocked?	Explain how to use Roman symbols to write the numbers from 1 - 20.	Find a picture of a mammal and say why you think that it is a mammal.
APPLICATION	To use Some previously learned knowledge, rule or method in a new situation	If Goldilocks had come into your house what are some of the things she might have used?	Using Roman numerals, write and solve an addition problem with an answer no bigger than 20.	Collect pictures of ten different animals. Arrange them into mammal and non-mammal groups.
ANALYSIS	To break information into parts to explore understandings and relationships	What parts in the story of Goldilocks and The Three Bears could not have actually happened?	Compare the Roman numeral system with the decimal system.	Compare mammals with reptiles. How are they alike? How are they different?
SYNTHESIS	To put together ideas in a new way to develop a new or unique product	How might the story have been different if Goldilocks had visited three fish?	Create a numeration system of your own.	Using the characteristics of mammals, create a new mammal of your own.
EVALUATION	To judge the value of materials or ideas on the basis of set criteria	Do you think Goidilocks was good or bad? Why do you think so?	In what ways would your system be better than the Roman numeral system?	Do you think your creature would be helpful or harmful to society? Why?

Figure 4.

Bloom's Taxonomy of Cognitive Processes

Source: Dalton and Smith, 1986.

Strategies to develop reflective and metacognitive thinking.

1. **Understand the task** Define the requirements. Evaluate what is known and what needs to be changed.	What am I asked to do here? What do I already know?
2. **Plan and form goals** Choose appropriate action.	What strategies could I use? What do I need to do first?
3. **Act on plan and monitor progress**	Is my plan effective; does it need adapting? Can I justify my work?
4. **Regulate behaviour and plan**	How would I do it differently next time?

Figure 5.

Model of Self-questioning

Source: Wilson and Wing Jan 1993.

	EVENT	SITUATION	CHOICE	PERSON	REASON	MEANS
PRESENT	What is?	Where When is?	Which is?	Who is?	Why is?	How I is?
PAST	What did ?	Where/ When did?	Which did?	Who did?	Why did?	How did ?
POSSIBILITY	What can?	Where/ When can?	Which can?	Who can?	Why can?	How can?
PROBABILITY	What would?	Where/ When would?	Which would?	Who would?	Why would?	How would?
PREDICTION	What will?	Where/ When will?	Which will?	Who will?	Why will?	How will?
IMAGINATION	What might?	Where/ When might?	Which might?	Who might?	Why might?	How I might?

From C. Wiederhold, Cooperative Learning & Critical Thinking: The Question Matrix, Resources for Teachers Inc., San Juan Capistrano, California, 1991

Figure 6.

Question matrix

Source: Langrehr, 1993c.

Strategies to develop reflective and metacognitive thinking

Colour of hat	Thinking process involved	Example of type of question
White	Concerned with facts and figures.	What are the facts and figures concerned with school holidays?
Red	Concerned with emotions.	How do you feel about school holidays?
Black	Concerned with negative thinking.	What are the disadvantages of school holidays?
Yellow	Concerned with positive and optimistic thinking.	What is great about school holidays?
Green	Concerned with creative thinking and the generation of new ideas.	How would you change school holidays?
Blue	Concerned with the control and organisation of thinking processes.	What are the pros and cons of school holidays according to all participants?

Figure 7.

Six Hat Thinking - de Bono

Source: Wilson and Wing Jan,1993.

Strategies to develop reflective and metacognitive thinking

Type of question	Literature-The Gingerbread Man	Social Education topic -Early Settlement of Australia
Quantity	How many ways can you think of that the gingerbread man could have been tricked into stopping?	How many sources of food could the members of the first fleet have found when they arrived in Australia?
Change	How would the story have changed if the old man had been able to catch the gingerbread man?	How would Australia's settlement have changed if many of the members of the First Fleet had not been convicts?
Prediction	What if the fox had been a kindly creature and hadn't eaten the gingerbread man?	What do you think Australia will be like in 2100?
Point of view	If you were the little old woman what would you say about the events in the story?	If you were a member of the first fleet what would your story be?
Personal involvement	What would you have done to catch the gingerbread man?	How would you feel if you were an Aborigine at the time of the arrival of the first white settlers?
Comparative association	How do the actions of the fox in the gingerbread man compare with actions of the wolf in the Three Little Pigs?	How does the first white settlement of Australia compare with that of America?
Valuing questions	Do you think it was right for the gingerbread man to try and run away from the little old lady?	Is it ever right for one group of people to take over the land of another group? Why? Why not?

Figure 8.

Questions related to Creative Thinking - Victoria Ministry of Education

Source: Wilson and Wing Jan, 1993

Distinguishing facts from opinions.

1. Does this statement contain indefinite words such as might, could, possibly, predict, suggested? (opinion)
2. Is there objective or scientific evidence that the content of this statement is true? (fact)
3. Would most people agree with statement? (fact)
4. Has the content of this statement actually happened in the past? (fact)
5. Is this statement a feeling or belief of only a few people? (opinion)

Verbally summarising a reading

I. What is the main topic of this reading?
2. What is the key sentence of this reading that highlights the main aspect of the topic that is being discussed?
3. Which sentences are relevant in that they help one to understand the aspect being discussed?
4. Are there any groups of related things in the reading that can be summarised by a single word?

Distinguishing an inference from a definite conclusion

I. Is this conclusion about the feelings, motives, or future actions of people? (inference)
2. Is this conclusion about the intended meaning of an advertisement, picture, or statement? (inference)
3. Is this conclusion about numbers. types, or other directly observable features of things? (definite conclusion)

Solving a problem

I. What do I have to find? (goal setting)
2. What am I given? (date checking)
3. Are there any limits or conditions given?
4. Have I done something like this before, (recalling past)
5. Which formula or principle do I have to use here?
6. What do I have to be careful of in these problems?
7. Can I sketch this problem?
8. Have I underlined important facts?
9. Can I break the problem up into small parts for solving?
10. Can I use simpler numbers, parts and so on?
11. What is the first thing to do and why?
12 What is the next thing to do and why?
13. What will happen if I do this?
14. How am I going?
15. Does this answer check out?
16. Is there a rule or technique I should remember for next time?
17. What were the tricky parts?

Making a decision

1. What do I have to choose between here?
2. What are the choices or alternatives?
3. What are the advantages and disadvantages of each choice?
4. From number 3, what are some relevant criteria for comparing the choices?
5. How does each choice rate with respect to these comparing criteria?
6. Which choice rates most highly overall?

Figure 9.

Checklist of Questions for Problem Solving, Decision-making and Information Processing
Source: Langrehr, 1993c.

Judging the reliability of a report or statement

1. Did the person see the event first hand?
2. Does this person have a vested interest in this topic?
3. Does this person have a good reputation?
4. Is this person emotionally stable?
5. Does this person frequently write about this topic?
6. Is this person biased about this topic?
7. Were other people present when this person saw this event?

Judging bias in a picture or report

The term group here refers to groups such as females, black people, and poor, weak, or old people.

1. Is this group only shown in helping rather than leading roles?
2. Is this group only playing passive, safe games, rather than active, risk-taking games?
3. Is this group mainly placed in the background rather than the foreground?
4. Is this group mainly shown in non-professional roles?
5. Is this group mainly shown as being lazy or frightened?

Analysing the design of something

1. Why does this have this shape rather than other shapes?
2. Why is it made of this material rather than others ?
3. Why does it have these different parts?
4. Why does it have this size, colour, texture, and so on, rather than other possibilities?

Visually summarising a reading

1. Is this reading about smaller and smaller parts of a topic, different aspects of a topic, a cycle. causes and effect, two things being compared, three or more things being compared ?
2. Which is the best standard visual organiser on which to display the key terms here and how they are connected?

Making a generalisation

1. What are five or so examples of this thing?
2. What are some properties of each of these things?
3. Which properties do all of these examples have in common?

Creative problem solving

1. What is the first object that comes to my mind?
2. What is the problem?
3. What are four or so properties of my random object or input?
4. Can I use any of the properties of my random input to come up with a fresh, unexpected solution to my problem?

5 What is another random object to help me make more creative links between its properties and the problem.

Figure 9, Continued.

Critical thinking

1 Where is the evidence for this?

2 What is the meaning of this...?

3 What is being assumed here?

4 What are the consequences of this...?

5 What is the opposite point of view?

6 What is the main point here?

7 What is an example of this...?

8 Are these reasons adequate?

9 How reliable is the source of information?

10 How consistent is this information?

11 How relevant is this factor, criterion, data ... ?

12 Is this information biased in some way?

Figure 9, Continued.