A learning base for the education of gifted and talented students

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A recurrent theme in Australian education in the nineteen nineties has been a focus on the provision of educational opportunity for students identified as gifted and talented. This focus has paralleled a change in educational policy making from the 1970s and 1980s, during which the learning needs of these students were largely ignored.

This focus has been from the more global program level, demonstrated as an increased interest at the pedagogic, institutional and policy levels of educational decision-making. In Victoria, for example, it has been on new programmes. The issue of whether they cater most effectively for how these students learn has been largely ignored.

The present paper is referenced on the belief that the provision of quality educational opportunity for gifted and talented students needs to be underpinned by a model of learning. It argues that teacher decisions about the education of these students can be enhanced be a consideration of how these children learn. It

- examines why teachers working with gifted and talented students need this knowledge,
- presents a model of learning that is validated against its capacity to explain the characteristics of gifted and talented learners learning and
- reviews briefly its implications for teaching gifted and talented students.

Characteristics of gifted and talented learners learning

Who are the students targeted by the present paper ? Educators familiar with this area will be aware of the plethora of definitions of giftedness and talent .

As a start to identification, it is useful to examine their learning characteristics. There are obvious dangers in doing this for any group. Charges of stereotyping, categorization and inappropriate generalization are elicited. The present paper identifies these characteristics so that they can be analysed in terms of a theory of learning. The following set has been assembled from the writer's experience and is supported by several investigators (Barton & Starnes, 1989; Clark, 1992; Cordell & Cannon, 1985); Emerick, 1992; Hishinuma, 1993; Krissman, 1989; Nielsen, 1989; Silverman, 1989).

Superior learning processes These students usually learn quickly and readily and see connections between existing and new ideas faster than their peers. They

- make decisions quickly and link ideas in complex, lateral, unexpected ways,

- keep track of several ideas at once, give unexpected responses to questions ,
- think in larger increments, skip steps in their thinking,
- require fewer repetitions of and less exposure to an idea in order to learn it.
- use imagination, fantasy and humour at a high level.
- have a well-developed memory, particularly for the areas of interest
- may have difficulty learning in particular areas, for example rote learning, spelling, handwriting, rote recall of arithmetic information.
- may show carelessness in handwriting and similar routine tasks
- ignore details in some areas.
- may become bored and frustrated if the learning pace is too slow.
- may have difficulty putting into words how they thought or solved problems, because (1) they are thinking faster than they can vocalize or (2) they don't believe they need to communicate to others how they think.

Learning outcomes. These students usually have a wide general knowledge and an extreme knowledge in areas of interest that is commensurate with that expected of older pupils. They

- know about things of which other pupils seem unaware.
- may demonstrate advanced vocabulary, particularly in areas of interest and communicate ideas fluently

Motivation to learn and learning style These students are 'self-driven' and motivated to 'want to know', learning spontaneously without direct teaching; they

- frequently learn independently, prefer to direct their own learning, may have difficulty in situations in which their learning is directed (authoritarian teaching contexts) and those in which their curiosity is not challenged.
- may question group learning situations and even become behaviour and discipline problems in more directed, closed learning contexts or in repetitive tasks. They may rebel against conformity .
- can concentrate for prolonged periods and show high levels of perseverance. This high level of energy expenditure may lead to complications in other areas.

Interpersonal interactions They may feel different from peers and alienated because they don't see themselves getting the necessary positive affirmation from their peers and teachers but not understand why. They may

- not see their exceptional abilities worthy of valuing; they may not get the affirmation because they don't know how to show what they know so that it fits with the group expectations.
- have difficulty identifying with a peer group; they may
- feel they have less in common with peers, (their peers may not comprehend their ideas and they feel that there is something wrong with them).

- have difficulty communicating with same-age peers because of interest difficulties, and with older children who find them emotionally immature; they seem 'the odd one out', experience loneliness and isolation and not feel part of any group.

- not find suitable role-models in the peer group.

- over conform in the peer-group situation when they find social acceptance difficult. They are often sensitive to rejection by others and try to conform so that they do not appear different. They may display heightened perceptions and sensitivities.

- be not as carefree and as easy-going as class peers but instead are more serious.

- be irritated by class peers who do not understand the ideas at the same depth.

- appear to lack confidence in their interaction with their peers.

- have difficulty understanding and valuing the learning of others.

- have difficulty trusting others

- feel for others and events in the world, worry about children who they see being unfairly treated, take on the problems of others and world problems as personally affecting them, they have a heightened awareness of moral values,

They and their peer group need to learn to accept and value individual strengths and differences. Counselling, practical valuing of individual abilities, cross-age and peer-group teaching may be useful.

Self-perceptions and affective aspects of talented children learning. They

- often have low self-esteem that restricts their preparedness to produce academically. Their self-talk is frequently more pessimistic than optimistic and they need to learn more optimistic scripts as options.

- set high (often unrealistically high) standards and goals for themselves and judge themselves harshly.

- may worry about expectations that they should be 'perfect' and yet know that they aren't. If their giftedness or creativity is perceived to be threatened, they withdraw; they frequently lack the analytic strategies necessary for dealing with the threat more constructively.

- may have difficulty understanding the importance of 'risk-taking' in learning, may have a real sense of failure and may become school refusers, etc.

- may be more anxious, often put stress on themselves and feel stress from others due to unrealistic expectations.

- are frequently interested in consequences, the future, etc., but may see' consequences that peers don't, tend to worry, appear to be less self-confident, less sure of self.

- may have difficulty resolving inner conflicts, unsure of themselves.

Uneven rates of development These students often show uneven rates of development; aspects of their overall functioning may develop at different rates. They show an 'asynchrony' in development so that they may

- present as emotionally or physically immature.

- show specific learning disabilities in particular areas, for example rote learning, spelling, handwriting, rote recall of arithmetic information.

A model of learning needs to explain these types of characteristics.

Why do teachers working with gifted and talented students need a knowledge of learning ?

School staff need to make decisions over a broad range of issues. The following is a sample of some of the decisions a contemporary classroom teacher may need to make to make about teaching gifted students.

(1) How need to implement effective teaching, assessment , management and discipline procedures that reflect the diversity of learning approaches in their classes and that encompass the directions and constraints that society imposes on education ? Teaching strategies need to be student- inclusive and provide them with the opportunity to see themselves making optimal progress. Gifted and talented students display learning characteristics different from those of their peers and often don't match the 'gifted stereotype'. Their learning characteristics can be perplexing and frustrating to teachers. They frequently need assistance and counselling in forming functional peer interactions. To do maximum justice to these students, teacher decisions need to be based on a sound model of learning.

(2) How to contribute to the development and implementation of school based policies for these students that reflect current thinking in learning process and outcome ?

(3) How to interpret and implement externally initiated educational policy change and initiative in the area of giftedness ?

(4) How to work at the interface between these students and their peers, their parents, the school and the community ? This ranges from counselling parents and students to helping these students deal with the multifaceted interactions between the community and the school.

(6) How to contribute to resource allocation for school programming for these students ? Teachers are required , often in the face of competing demands for the limited resources and need to make these decisions, at least in part on known effective learning criteria.

(7) How to manage the on-going monitoring and evaluation of learning and teaching programmes for these students in their classroom as efficiently as possible ?

(8) How to remain abreast of current developments in curriculum, learning and teaching ?

These types of decisions can be made on the basis of a number of criteria that draw from different knowledge bases, as shown below;

content area	policy	business management	personnel management	institutional knowledge	modern theories of learning

This paper argues that these decisions need to draw, at least in part, on a knowledge of contemporary theories of learning. All of the areas above require an understanding of learning. Helping students to acquire an understanding of learning and the ability to manage themselves as learners, usually seen as essential outcomes for schools as we move towards the next century, can be best achieved when school staff have explicated their personal theory of learning.

Many of the problems that arise with gifted children in classes originate in teaching practices that do not take account of how these students learn. The unrealistic expectations that teachers frequently have of them, for example, are reflected in the expectation that they will be 'good at academic learning across the board'. In many school situations it is easy to overlook the needs of some gifted and talented students and to make decisions that don't take account of how they learn.

Characteristics of a useful model of learning Having shown the need for a foundation model of learning, what might be its characteristics ? One aim of this paper is to synthesise the learning needs of gifted and talented children with a useful model of learning. There have been several earlier theories of learning, for example,

(1) behaviourist theories, saw learners as passive organisms who during learning are programmed in different ways.

(2) developmental models such as Piaget's, saw active learners actively re-arranging their knowledge in a predictable predetermined way as they all move along the same path.

(3) network-type and schema models saw learning in terms of how knowledge is organized.

(4) information processing models explain learning in terms of how information is processed.

(5) socio-cultural interaction models and transaction explain learning in terms of the internalization of socio-cultural knowledge and

(6) constructivist models explain learning in terms of the building of subjective models of the world.

None of these has had a lasting effect either on general teaching and educational processes or, more particularly, on the education of gifted and talented learners for a number of reasons, not the least of which being that they were not classroom or teacher friendly. A 'friendly' model of learning will

(1) explain gifted learning; it needs to do more than simply describe it. It needs to account for the types of learning behaviours that gifted and talented children display.

(2) explain as much as possible 'whole-child' operation - explain both positive and negative aspects of gifted students learning.

(3) predict particular areas of learning behaviours and

(4) map into useful teaching strategies.

Model of learning

How does learning occur ? We need for a model of how learners learn, both in groups and individually at any time. First we need to look at a definition of what we mean by learning.

What do we mean by learning ?

Learning involves a change or re-organization of an individual's knowledge base. It is more likely when learners construct challenges with which they judge their existing knowledge to be insufficient in some way to deal and expect to achieve a level of success in learning. The goal of the learning is to deal more effectively with the challenge in the future. Learning is purpose or goal oriented; learners learn when they are motivated or have a goal for learning. The goal can range from satisfying curiosity and responding to one's own interests, attaining a temporary goal (reach an object in a novel way), to solving a problem or to obtaining the valuing of others in some way. Learning can be individually -oriented or socially oriented. In looking at the learning of gifted and talented students in the present context, we are focusing more on school-based, institutional learning, that is, the learners internalising socially or culturally determined ideas.

The social basis of learning

Learning is an interaction between learner and the cultural -social groups in which the person learns. We present a social -constructivist model; an individual's knowledge base changes within a social-cultural context.

Social processes influence learning in formal educational contexts in several ways. They learn culturally determined and valued ideas and often need to think in socially valued ways. Given the

cultural origin of the ideas, the culture initiates the purpose for learning and needs to challenge the learner to 'know'.

In formal learning, learners need to align their experiences and interpretations with the culturally valued meanings. They need to engage in a meaning or understanding negotiation process (Voigt, 1994). They interpret ideas using their existing knowledge, try out their guesses and receive feedback for this trialing. The environment evaluates what learners display by discussing, challenging, validating or extending ideas. Learners learn to use how others respond to their displays. They learn within a network of social-cultural interactions that direct the learning activity. This negotiation can be complicated by a learner belonging to different social-cultural groups at different times and needing to negotiate different meanings for the same socially-transacted items.

The cultural - social dimension of the model of learning explains some of the difficulties many gifted students have in formal learning contexts. They construct impressions of an idea that are often qualitatively different from those of their peers. When they negotiate meaning, their peers frequently don't understand the ideas they communicate. The feedback they receive may be due to a misunderstanding of the quality of the ideas by their peers, who often communicate a lack of acceptance of them. Communication, then, may lead to rejection by the group. This can lead in turn to a tension for them between how they think naturally and what they believe they are permitted to think and learn by the social group if they are to receive positive group valuing. Some prefer not to engage in meaning negotiation. They are less prepared to engage in group learning activities and to show the outcomes of their guessing. Their earlier learning displays were not valued by the group, leading to them mistrusting it. They may see that the group doesn't value what they know but they don't know how to go about getting more positive feedback. They frequently need to learn how to learn in groups and to understand how others learn.

A second aspect of the social-cultural influence relates to the preparedness of these students to be programmed by their culture. Formal academic learning involves students learning culturally determined ideas. Students differ in their preparedness to be programmed in this way. Some expect to be programmed at school, while others seek to impose their own ideas on the culture. Gifted students are more likely to be in the latter group.

Students differ in their preparedness to be organized as learners. Gifted students are frequently less prepared to be organized. As well, because their learning is more idiosyncratically oriented, they don't spontaneously encode in words what they do to learn and often have difficulty describing in words how they went about learning an idea or solving a problem.

They often develop a greater susceptibility to group valuing than their peers. This is because of a greater likelihood to receive negative feedback from peers and their well-developed ability to perceive

consequences a relatively long way down the line. Alternatively, they may simply withdraw from the social group and become, for a good deal of their time at school, a social isolate or 'oddity'.

These issues affect directly how we teach classes in which these students are members; in the opportunity we give students to negotiate meaning , for learning to give, receive and use feedback, in how different children perceive themselves as successful and in how learners frame up challenges for learning in different ways. Our teaching needs to balance the learning of culturally valued ideas with individually valued ideas and more open-ended learning opportunities. Allowing some students to modify their ideas to match culturally-defined ideas, as well as expecting others to internalize the culturally-defined version needs a broader range of teaching strategies. Providing greater opportunity for self-directed learning, in parallel with the opportunity to learn how to learn successfully in groups is necessary. Helping these students make opportunities to show what they know in ways that match their ways of learning and that increase the likelihood of group valuing is also necessary.

Within learner differences

In the social negotiation of meaning, different learners negotiate meaning differently. Individual difference can arise in a range of ways. Students may represent their existing knowledge differently or engage in the re-organizing process in different ways. Some can communicate their ideas in some ways more easily than others. Learners may differ in their preparedness to construct challenges or to show that their existing knowledge is insufficient. In terms of a metaphor for learning at any time it is proposed that

(1) learners have one or more sites for learning, in which the reorganization of existing knowledge occurs. Terms used to refer to these sites include thinking space and short term working memory (Baddeley, 1990).

(2) the total amount of data that can be accommodated at any time in the learning sites is limited. This restriction can be interpreted in terms of thinking space and the allocation of attentional resources.

(3) new ideas are learnt in terms of the learners' existing knowledge; learners interpret information during learning in ideosyncratic ways.

(4) the ideas the learner is thinking about can be coded or represented in these 'sites' in different ways; we can look at ideas in different ways. Each code links the new ideas with what is already known in particular ways, is associated with thinking about the ideas in a particular way and delivers a different perspective on the same ideas.

(5) ideas can be 'moved' between codes via a recoding process that brings the new code to bear on the ideas. The meanings that they had in earlier codes can be retained.

(6) learners differ in how they act on the ideas during learning: some learners operate more analytically while others may operate more synthetically.

(7) in any particular learning act, learners manage, control and direct their learning; they can, for example, monitor progress being made during the learning, ask themselves questions about what they are learning etc. Our knowledge as learners affects how we learn. We tell ourselves early in learning how we will feel about learning the idea.

(8) the opportunity to display what has been learnt is necessary for a variety of reasons and that learners prefer to do this in different ways. We may ensure that the change in knowledge is retained; we act on an idea in various ways to retain it.

This metaphor of learning is taken from Munro (1996b). It is shown schematically in Figure 1.

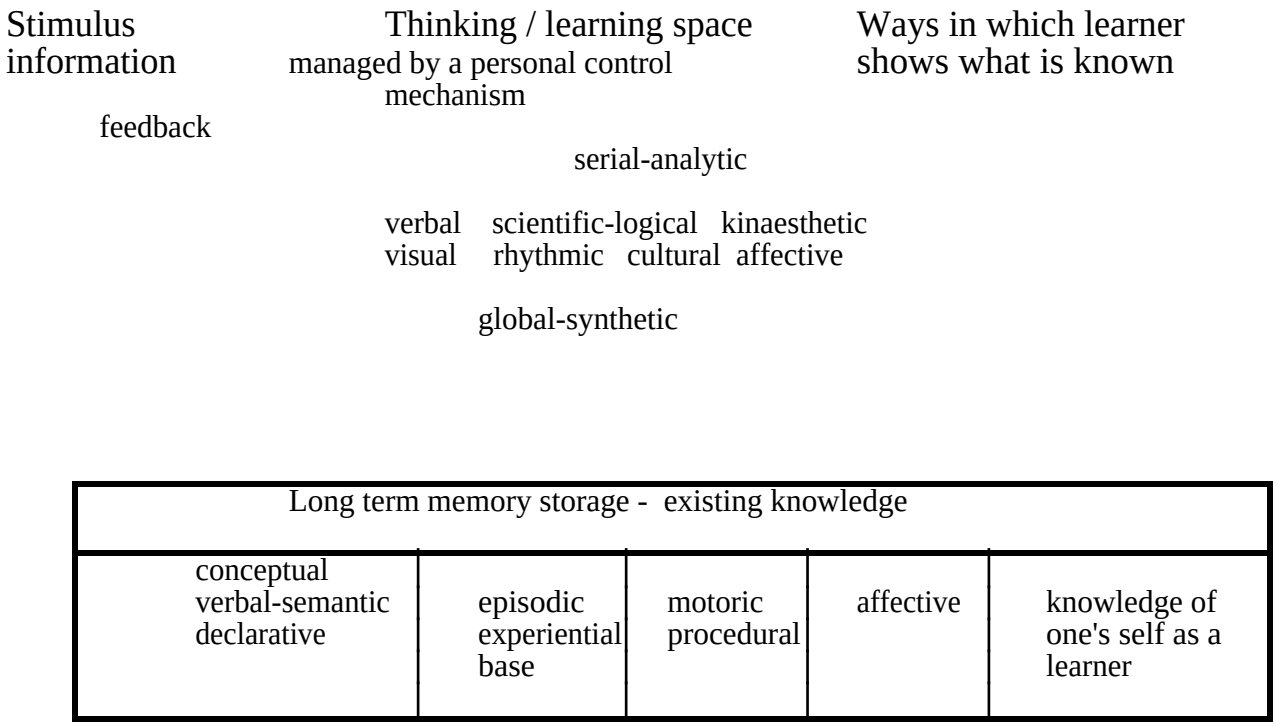

Figure 1 : Diagrammatic representation of the metaphor of learning.

Differences in how ideas are coded during learning The ideas manipulated during learning need to be coded or represented in the 'sites' in forms that allow learners to think about them. Whenever we think about an idea we need to link it with other ideas, using what we already know. Our existing knowledge gives us these ways of thinking or 'thinking codes'. These codes represent what we

already know about how ideas can be related or linked. Ideas can be coded or represented in different ways.

Each code involves organizing or relating the ideas in particular ways, that is, draws attention to particular aspects of an idea. Contemporary models of cognitive processing propose two main encoding systems; verbal-propositional and nonverbal imagery knowledge (Halford, 1993). Preferences in how learners use particular thinking codes leads to cognitive styles which are dispositions in how we think. The present model (Munro 1996b) proposes that students have access to several alternative codes in which to learn, as follows:

- **verbal/linguistic code**; knowing by using one's understanding of words and properties of language, (thinking by using words, sentences and verbal propositions). It allows some students to think at an advanced level using linguistic templates. They have a rich vocabulary, read and comprehend sophisticated text, engage in complex verbal discussions and debates and reason about verbal concepts at an advanced level. They readily learn and think about ideas by discussing, arguing and debating. They may have difficulty using what they know to solve real-life problems and translating their ideas into actions.

- **logical/mathematical code**; understanding by using abstract mathematical or scientific concepts logic and symbols' to link ideas. This code allows some students to build ideas by reasoning inductively and deductively, look for organization and logic, analyse complex patterns and recognize order and consistency at a high level, make objective observations, draw conclusions and formulate sophisticated hypotheses as well as applying general rules to particular situations.

- **visual/spatial code**; understanding by making nonverbal images of ideas, either by processing earlier episodes or by constructing icons or templates that operate as prototypes for concept that they have learnt. This code allows students to relate ideas using spatial and temporal properties. When used most efficiently, some students can manipulate a comparatively large number of spatial relationships or images or episodes at once allowing them to synthesise high levels of previously unrelated ideas ; they 'slot' several specific pieces of information into a mental picture in unique ways. They can manipulate images by moving them around, imagining how they change over time. This leads to high level creative and lateral thinking.

- **body/kinaesthetic code**; understanding by using actions to represent ideas. Learners using this code think in terms of action sequences or procedures. Some students think about action sequences in complex and sophisticated ways. They solve complex problems efficiently and elegantly using action-based comprehension.

• **rhythmic code**; knowing by using rhythm, repetitive patterns and rhyme, learning ideas by rote or by chanting. Some students develop an elaborate rhythmic knowledge that they use to identify and produce intricate and creative rhythmic patterns in music, movement and in other conceptual areas.

• **affective / mood representation;** understanding in terms of affect, emotion, feeling or mood. Some students develop a highly differentiated and integrated mood representational system that they use to learn and understand ideas. They can recognize and respond to fine discriminations in affect or mood, can display differences in mood in a range of ways and can 'read' and respond effectively and rapidly to the emotional characteristics of a context (a painting, novel, a social interaction, etc.) They can understand the factors that manage emotion (the attribution of success and failure, level of persistence, etc).

• **interpersonal representation**; understanding in terms of historical, social, cultural or religious knowledge. This involves ideas referenced against a network that is defined either by historical, cultural or religious relationships. Cultural and religious 'logic' refer to the linking of ideas on the basis of cultural and religious belief systems. These beliefs achieve the status of propositions. These logics meet criteria that differ form those for mathematical-scientific logic, verbal-linguistic logic and episodic logic. Students from different cultures can interpret the same teaching differently. One cultural perspective may encourage unquestioning construction of the ideas as accurately as possible while another may encourage questioning and successive approximations. Learning from a perspective that sees no gender difference in access to mathematics learning will be different from one that believes that males have a greater right to learn mathematics.

Thinking strategies linked with each code Linked with each code is a set of thinking strategies that actually drive the code in the sense that they prescribe questions that students can ask and information students can look for. The sets of thinking strategies associated with each code are described in much greater detail in Munro (1996b). The thinking strategies provide the means for assisting students to broaden their approach to learning. They can do this by learning new ways of thinking.

The issue of thinking strategies has become a major focus in the area of gifted education. There has been a tendency to develop thinking strategies as an issue unrelated to other areas of learning Within the present model of learning, one subset of thinking strategies, particularly the cognitive strategies, are assumed to be linked with the use of the different codes.

Moving ideas between codes Learners need to learn how to move ideas between codes, to switch an idea from one code to another by a recoding process. This is important gifted students. Learning situations usually provide a limited range of options for showing what one knows. Gifted students can learn to do this so that it fits the constraints of the learning situation and so that their peers will be more likely to value it. This doesn't involve 'scaling down' the complexity of the idea,

but rather recoding it to a form that takes account of the audience. Gradually they need to learn to build an idea in one code (probably one of their preferred codes) and then switch it to another in order to show what they know in acceptable ways. The recoding phenomenon is described in more detail in Munro 1996a and b.

Relating the ideas represented : analytic or wholistic strategies A second dimension is how the ideas are manipulated within each code; either (1) analysed into parts that are then linked up or (2) integrated with other ideas, with each idea being treated as a whole rather than being analysed into parts. The first type of strategy is described as analytic while the second is synthetic or wholistic. While most learners use these strategies selectively, some use one excessively.

Gifted and talented students are more likely to use wholistic than analytic-sequential strategies. They are more flexible in their thinking and can often tolerate ambiguity and unanswered questions. Because they are often more likely to ignore or miss specific details unless these are integrated within a larger conceptual structure, they are more likely to have difficulty learning ideas taught in a sequential, rote way, for example, spelling and aspects of mathematics such as rote recall of the tables. They are often more able at reading comprehension than at reading words accurately because they have the verbal reasoning knowledge necessary for reading comprehension but are less likely to engage in the analytic activities needed for learning to recognize written word patterns .

Formal teaching usually assumes students learn best by being presented with small parts of an idea at a time arranged sequentially. This approach supports learners using strategies that analyse ideas using analytic criteria prescribed by the social group or culture. Students can, of course, analyse ideas in ideosyncratic ways. When they do this, the criterion for the analysis is known only to them. Often when gifted students analyse subjectively an idea into parts and manipulate it in a novel, creative way, they have difficulty describing what they did; they didn't encode what they did in words. When students analyse ideas into parts in the culturally recognized ways they also learn the ways of talking about the analysis and can more easily tell people what they did. Those who prefer to use global-wholistic strategies are less likely to do this, don't get positive regard for what they have learnt and often become alienated from effective learning.

Just as each of the codes is linked with a set of thinking strategies, so the two types of manipulation or processing strategies are managed by self-instruction sequences. These are described more fully in Munro (1996 a and b).

A management / control mechanism This is how learners manage or regulate their learning, that is, their metacognitive knowledge. They use this to plan how they will learn, to monitor their learning, to evaluate its effectiveness in terms of some goal or purpose and take further strategic action if necessary and to review their change in knowledge.

Gifted students use aspects of this control mechanism extremely effectively. Their ability to direct and regulate their learning, to plan, monitor their learning progress and take further strategic action if necessary is obviously very well developed. In fact, much of this activity by these students seems to be automatized.

Their knowledge as learners, on the other hand and their lack of self confidence in the group learning context can mean that on occasions they opt not to engage in learning. They perceive consequences bit don't have the experience necessary to deal with this.

In summary, this learning model, gifted learning is associated with the extremely efficient use of two or three of the codes, particularly in parallel with the use of global-synthetic strategies. Other codes may not be as well developed ; students display gifted learning in some areas and immaturity in other areas. In the favoured codes, they can deal with several ideas at once because they have automatized these codes and give the impression of thinking synthetically or 'simultaneously' rather than sequentially.

Implications for teaching gifted and talented students

This model of learning has a range of implications for educating gifted and talented learners. These implications are developed in greater depth in Munro (1996b).

1. What is our theory of learning ? Teachers need to explicate and clarify their personal working theory of learning, extract from this a theory of how children who are gifted learn and thence a set of teaching and curriculum implications. Only when this has been done can teachers ensure that their practice is based in part on a theory of learning. From this, teachers may look at

(1) the types of learning supported by their teaching and the extent to which they cater for the gifted students in their classes. They can audio- or videotape lessons or have a colleague monitor the teaching strategies used and the opportunities provided for students to learn and to display their knowledge.

(2) how children who are gifted have been identified within the class, whether some students may have gone un-identified, how the preferred ways of learning of gifted students have been observed, etc. A periodical audit of the effectiveness of procedures used for identification and teaching allows teachers to keep abreast of how students are learning and whether some students are more effectively showing what they know.

(3) how problems and difficulties in learning for any student can be caused by a mis-match between teaching styles and preferred ways of learning**.** Mis-matches can lead to difficulty learning, high levels of frustration and anxiety, behavioural and discipline problems and ultimately alienation from school. Teachers can explore links between their teaching styles and the learning styles of gifted students and use this to broaden their teaching styles.

Students can recognize mis-matches between teaching and learning styles and explore ways of managing these constructively.

2. **Identifying gifted and talented students.** The model suggests that students can display giftedness in any of the codes. Students can display high level in learning in any combination of the codes. Once the teacher had identified the developmental levels in an area of knowledge and characteristic outcomes for each level, a range of procedures can be used to describe the unique knowledge of all students, including those who are gifted. It is not restricted to the traditional verbal linguistic-logico-mathematical types of giftedness.

It recommends a range of procedures for identifying the special abilities of these students, ranging from classroom-based observation of children's learning in various environments, through records of achievement and work folios, displays in creative contexts (creative writing, art, research, problem solving, art, inventions, music, oral presentations (recorded on tape), peer observations, self-rating scales to the use of general ability assessments that are suitably interpreted.

3. Present ideas in the range of codes. Any topic can be developed through activities in each of the codes. This allows us to cater for the learning needs of all students in our classes. By introducing the ideas in an open-ended way in each code we can encourage the involvement of gifted students. An example of what we mean is shown for the topic of evaporation.

Code ideas **culturally, socially, historically**	Code ideas **logico-mathematically**	Code ideas **affectively**
Use of evaporation in history ? How is evaporation used in different communities ?	Is there the same amount of water in a room when a dish of water evaporates? How has it changed?	What feelings would you have if you evaporated ? (light-headed, strung out ?)

EVAPORATION

Code ideas **verbal - linguistically**	Code ideas **visual-spatially**	Code ideas in **actions in episodes**
Brain-storm ideas ----> concept map -------> network map Produce, write, design a text or lesson to teach evaporation	Imagine, draw, collect as many situations as you can in which evaporation occurs, for example * water on a dish.	Make an action model of evaporation (for example, corks flying out of a shaken jar).

Strategies for developing the various types of activities in each code for a wide variety of subjects and topics are described in Munro (1996a). Teachers can use this framework :

(1) as a means for developing lesson plans that encourage building ideas in each code. A teacher or a faculty can, at one time, record the activities that they will use to teach an area and add to it over an extended period as they plan and teach the unit.

(2) after a group of students has used this structure, they can review the different types of activities and note how they can learn these different types of questions for each new topic that they are learning.

This format teaches ideas in 'learner-friendly' contexts that take account of preferred ways of learning. Students see their individual learning characteristics acknowledged and accepted. It also encourages the valuing of others. It focuses on a valuing of individual differences, accepting alternative ways of learning, completing tasks and asking open-ended questions.

4. Teaching students the thinking or learning strategies associated with each code Each code involves thinking about ideas in particular ways Children differ in their preferences for using these. Teachers can teach directly the ways of thinking linked with each code. Students learn to ask various types of questions for the different codes and examine issues such as how do the questions asked affect what one learns. For the thinking strategies associated with each code and how these can be taught, see Munro (1996a).

5. Students use their codes selectively to achieve particular outcomes Students can learn when it useful to use each type of thinking and how the different ways of thinking lead to different outcomes. They learn to match the desired outcomes of a task with the ways in which they need to think about it. Teachers can develop this understanding through a range of teaching procedures (Munro ,1996a).

6. Learning to look at an idea from different perspectives. Once learners have explored some core ideas in different codes, learnt some of the thinking strategies linked with each code, they can practise looking at an idea from each of the codes. This provides a richness and complexity to their understanding.

7. Talking about ideas from different codes. Formal education requires students to show what they know in words; either by talking or by writing. Teachers need to be aware that ideas from the verbal-linguistic garden bed are easier to express in this way than ideas from others. When students talk about ideas that they have built in visual-spatial and kinaesthetic codes, the first few words that they say are often 'verbal junk', the result of needing to recode the ideas into words. If these students are given a little more time, they can usually frame up a well-formed answer.

8. Students improve their knowledge of the codes for learning new ideas. Students need to improve the codes that they use for learning new ideas. This is particularly important for gifted learners. They can build complex ideas in one code but not be able to communicate the ideas at the appropriate level of sophistication because the other codes into which they translate the ideas are not sufficiently well developed to accommodate them. Students then become frustrated because they can't

show effectively what they understand. Teachers can help these students to enrich the different codes, such as learning how to use visual images or distinctive actions, practise using them and automatize their use. A range of teaching procedures for doing this are described in Munro (1996a). These include

(1) Extending the verbal linguistic code

- Coding type activities.
- Discovering language patterns.
- How does the writer/speaker 'come through' in the written / spoken product ?
- Questioning the content
- Differences in text structure
- What do word structures tell us ?
- How is our language changing ?
- What are the social functions of language ?
- Putting information together

(2) Extending the scientific / mathematical code

- Looking for patterns in numbers in nature, real life, modelling.
- Inductive reasoning
- Science type problem solving

(3) Extending the episodic-spatial code

- Put your mind into dream gear
- Forming and acting on mental images.
- Acting on episodic information
- Using visual imagery to organize information.
- Using schematic maps and other visual representations

(4) Extending the action / kinaesthetic code

- Observing, copying, remembering and demonstrating a sequence of actions.
- Communicating ideas through actions; speaking in actions.
- Reading other people's actions and body language.
- Matching actions with key ideas that you are using.

(5) Extending the rhythmic / musical code.

- Understanding rhythm in music.
- What sound is it ?
- How do sound effects help you to learn or remember something ?
- Types of rhythms

9. Give students a range of ways of showing what they know about ideas. Like others, many gifted students find it hard to display their knowledge of ideas in some formats because they haven't automatized those formats. For them there is often an additional problem; they haven't been taught the means for displaying their highly developed ideas. They need the opportunity to show what they know initially in ways that match their preferred modes of expression and learn conventional ways as a second step. Students who have a visual preference for learning can record ideas in drawing pictures first and then convert them to symbols or words later. Students who prefer to think linguistically can talk to themselves about ideas before they write them. Students who prefer to think kinaesthetically can act out the ideas before they write or speak about them. Some action learners try to avoid being seen to do actions. They need to be encouraged that it is acceptable and that it will help them to learn.

Where to from here ?

The theme of this paper is the need for the inclusion of learning criteria in the implementation of teaching activities for gifted and talented students and a 'learning dimension' in their curriculum. This is not about adding to this curriculum but rather examining ways of implementing it according to demonstrably sound learning principles. To what extent can the following issues be dealt with within a knowledge base that includes a knowledge of learning ?

(1) To what extent are models of extension referenced on a theory of learning ? Is the grouping of students on chronological age level the most justified organization on the basis of learning criteria ?

(2) To what extent are assessment procedures and policy determined on the basis of learning as well as pedagogic and political criteria ? Assessment practice is intended to assess the attainment of learning outcomes. To what extent does assessment practice take account of how students prefer to show what they know ? Some students prefer to display their knowledge analytically while others will display what they know in a global-wholistic way. Some learners will have built their knowledge in a verbal-linguistic format while others will have built their knowledge in a nonverbal visual-imagery way. To what extent do they provide learners with information about how they learn and what they have learnt ? To what extent do our reporting practices reflect good learning practice ?

(3) To what extent are timetabling arrangements and decisions determined on the basis of learning as well as curriculum and institutional criteria ? How are individual preferences in learning and learner variables such as access to existing knowledge taken account of by timetabling procedures ?

(4) To what extent are discipline policies and procedures determined on the basis of contemporary learning ? It seems obvious that behaviour management and discipline problems can be resolved less well from the curriculum and policy knowledge bases and need to be analysed and answered with knowledge of learning. Discipline problems may be due to misconceptions about learning, or a mismatch student and teacher goals. The concept of individuals operating on the basis of perceived options at any time and the need for them to learn ways of coping is not used sufficiently frequently in general discipline policy and practice.

(5) School alienation, particularly in the adolescent years is becoming an increasing problem for Australian schools, so much that there is now a national focus on the appropriateness of the early secondary years of education. To what extent are these problems a result of learning - teaching style mismatches ? Over the last decade I have had the opportunity to work with several teenagers who have displayed both very high level thinking, particularly in the visual - spatial or kinaesthetic global-wholistic areas and who have become alienated from school. Most had experienced little valuing of their existing knowledge and had gradually become 'turned off' formal education. None reported receiving assistance that focused on how they went about learning (although the majority were told what they should be like and how they were expected to operate). Ways of dealing with the learning - teaching demand mismatch were never explored. That their and other's talents are frequently lost to the Australian nation suggests a wastage that Australia can ill afford.

The argument in this paper is not that the types of decisions to be made in teaching gifted and talented students should be informed only by learning considerations. Rather, it is that learning considerations have some contribution to make, particularly given the basic aim of schools to facilitate the learning of all students.

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Reference notes

* These two references by the writer develop the issues in this paper in much greater depth, as follows :

Munro, J. (1996b). *Social, constructivist and information-processing: A teacher friendly model of learning* describes and applies the model of learning and

Munro, J. (1996a). *Gifted students learning : Basing the teaching of gifted students on a model of learning* describes its application to giftedness students learning.

Copies of these papers can be obtained from the publishers, Ed Assist, on (03) 9819-4040 or contact the writer on (03) 9344-8230.