Teaching gifted and talented students : a learning approach to differentiation.

Dr John Munro

Head of Exceptional Learning and Gifted Education, Faculty of Education, University of Melbourne

In this session we examine issues to do with implementing effective teaching or pedagogy for gifted and talented students that takes account of how these students learn.

The concept of differentiation is a familiar one in the area of gifted and talented education. Generally the focus is on the differentiation of the curriculum. The approach that I am recommending here is slightly different. It is on the differentiation of the teaching or pedagogy.

Pedagogic practice refers to the sets of procedures that teachers or other instructors use to manage and direct the learning of their students. It includes the procedures they use to challenge students to learn, to scaffold and guide their learning activity, challenge students to question what they know and to 'stretch' their knowledge, to provide feedback and to consolidate and review what they have learnt. These procedures influence the types of knowledge outcomes learnt and the attitudes and beliefs students learn about knowledge, how to learn and about learners and teachers and themselves as learners.

Teachers differ in the pedagogic procedures they employ in a range of ways, for example, the extent to which they control and direct the learning activity, the extent to which the procedures they use are referenced in students' knowledge procedures and the extent to which they guide students to improve their understanding of learning.

This approach recommends first that we identify what we know about how gifted and talented students learn. Second, it recommends that we map this knowledge into a sequence of teaching procedures. In other words, it recommends that we use what we know of how gifted and talented students learn to differentiate the teaching we implement. Our teaching is referenced on how these students learn.

The approach focuses on teaching gifted and talented students in regular classroom contexts. It is based on contemporary research about how these students learn. This research is used to the differentiate the teaching.

To introduce the approach to teaching for gifted and talented learners, we first examine basic assumptions we make about the nature of gifted knowledge and the characteristics of effective teaching.

Assumptions about the nature of gifted knowledge and learning.

The present approach discriminates between a person's capacity to learn, that is, to build knowledge and the knowledge the person learns. This conception derives from the nature of knowledge that underpins the distinction between giftedness and talent made by the Differentiated Models of Giftedness and Talent (DMGT) (Gagne, 2000; Ziegler & Heller, 2000).

These models distinguish between giftedness (high level broad-based general ability or competences that are untrained, displayed spontaneously and attributed in part to genetic sources) and talent (outstanding skills or abilities in specific areas. that. Knowledge and skills identified

as ‘talent’ are developed systematically and gradually as the aptitudes are transformed through the teaching.

The article ***Understanding Gifted and Talented Learning*** (Munro 2006) describes in detail the characteristics of knowledge we call gifted or talented. It also describes the characteristic learning patterns these students.

The characteristics of effective teaching.

Teaching can be evaluated in terms of the learning it fosters and supports. It is seen as effective when it optimally guides, directs and scaffolds students’ activity to enhance or to transfer their knowledge. What is the learning activity in which students engage to transform or enhance what they know ? It is possible to identify a number of key ‘learning actions’ that students can use (Munro, 2006, 2005a, 2005b) to enhance their knowledge. These are described in depth in the article *How people learn (*Munro, 2003). Learners

1. frame up purpose or reason for learning the ideas.
2. visualize the intended outcomes of the learning.
3. make links with and use what they know about the topic they are learning.
4. assemble possible learning pathways they can follow to the goal.
5. learn the new ideas in specific contexts in limited, supported, 'scaffolded' ways.
6. deepen or "decontextualize" their new understanding.
7. invest positive emotion in the new knowledge they have learnt.
8. identify how they learnt and the actions that helped them to learn.
9. store what they have learnt in memory and practise remembering it.
10. see they are making progress.
11. automatise aspects of what they have learnt so it can be used more easily to build further learning.
12. transfer and generalise the new knowledge.
13. organise what they have learnt for assessment purposes.

Each of these actions is backed by substantial research (Munro, 2005*). Effective teaching catalyses and fosters these learning actions. It guides students to use them in systematic, organized and integrated ways.

Synthesizing effective teaching with gifted knowledge and learning.

We can synthesize the model of effective teaching with our understanding of gifted knowledge and learning into a framework for teaching gifted and talented students. The model proposes that

1. gifted and talented learners can be gifted, that is, have advanced knowledge and learning capacities, in several possible areas or domains,

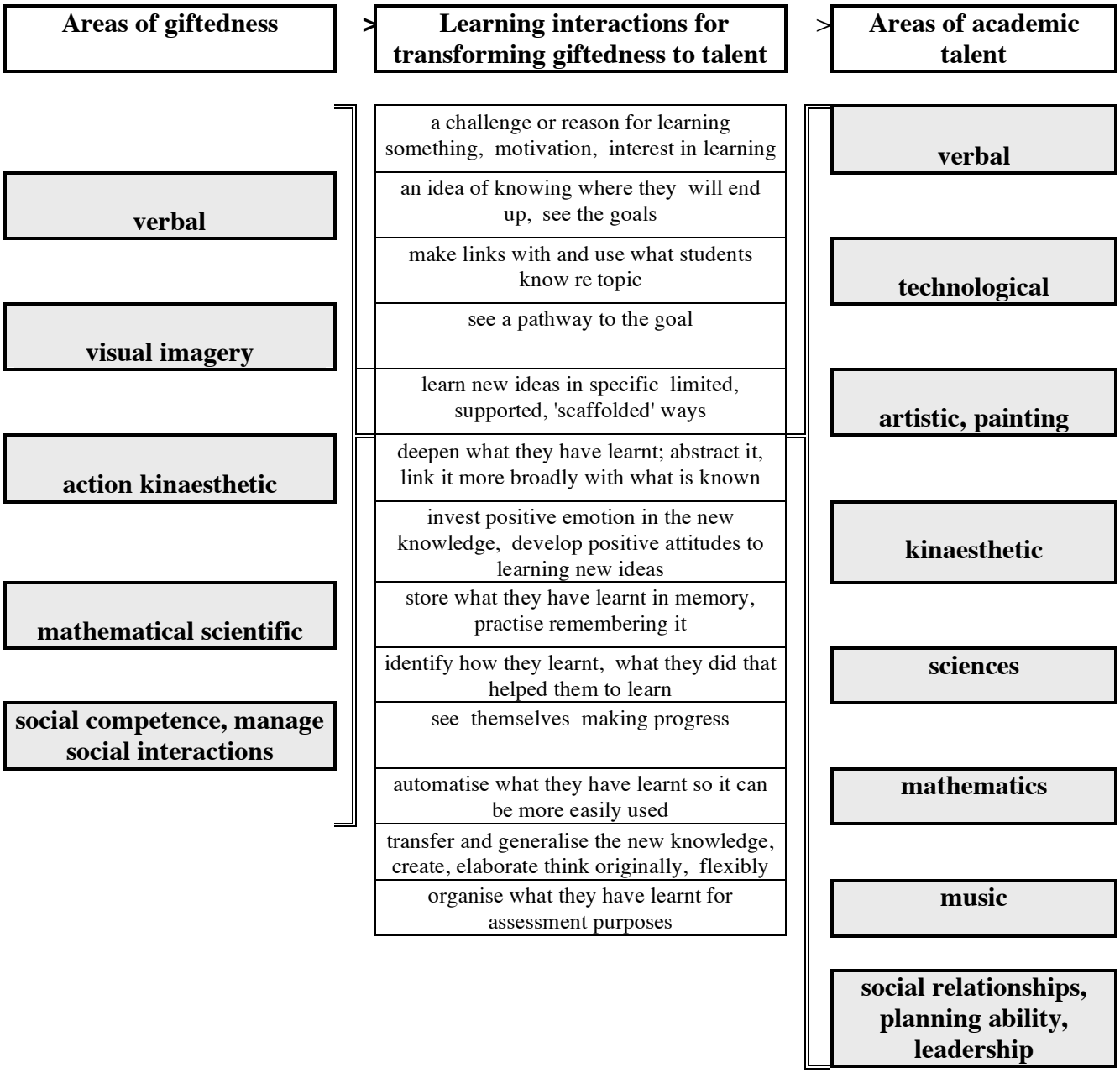
2. as well as being advanced, they have a high level of intrinsic motivation to learn, to respond to intellectual challenges and problems and to reduce uncertainty

3. they are able to link ideas in unusual, creative ways and can make ‘far transfer’

4. they can be assisted to map their gifted knowledge and capacities into talent, that is, to learn, by using each of the learning actions.

The various aspects of the framework are shown in Figure 1.

Figure 1 : The proposed teaching framework : Mapping multiple general capacities or aptitudes of high ability into talents.



Implications for identification

Superior general intellectual ability ?	High intrinsic motivation ?	Specific academic aptitude in a particular area ?
Gifted characteristics ?	Deep approach to learning ?	Creative or productive thinking ?
	High level metacognition ?	Superior achievement ?

A systematic framework for teaching gifted and talented students

In the article ***Understanding Gifted and Talented Learning*** (Munro 2006)**,** the set of key 'learning actions' described earlier is used to collate what is known about how gifted and talented

students learn. This collation led to a systematic description of how gifted and talented students learn that is referenced in evidence based research.

In the present article this systematic description of how gifted and talented students learn is mapped into a teaching framework. In other words, an approach to teaching that is explicitly based on how these students learn is developed. The framework can be used to guide these students to gradually enhance their knowledge and understanding of the topic.

This framework specifies pedagogic procedures teachers can use for each aspect of knowledge enhancement for a topic. It can be applied to topics in all content areas. Teachers can use it both for these students learning in regular class contexts and in small withdrawal groups. It can be used both in acceleration and in horizontal broadening programs.

Teaching GATS	Sample activities for teaching a topic
Activity to challenge the knowledge of GATS, to frame up questions that they pursue.	Use activities that encourage GATS to • introduce new ideas as real-life problems students solve • ask students to suggest questions the teaching might answer and what they think the answers are • present ideas that don't fit / clash with what students know. • have students predict outcomes and then check them. • use novelty. • give open-ended problems for which students frame up questions and action plans for solving them • use fantasy and imagination • have students invent problems, share with peers and discuss solutions. • use technology to introduce problems to be solved. To generate challenge tasks, bring together the two key ideas they need to learn. At this point provide activities that encourage GATS to • be intrinsically motivated to learn. . • 'take ideas apart', question and extend them by linking with what they know. and to say what they think, possibilities.
Activities to have GATS form an impression of where they will end up, see their goals, frame up action plans for solving them.	Have GATS • see what the outcome / solution will be like, • see where they are on their 'journey' through a maths topic, • where they are going next, negotiate the next part of their 'journey through ……'. Encourage GATS to • set goals in areas where they are not interested. • be intrinsically motivated to learn.
Activities to help GATS make links with and use what they know re topic	Present the stimulus materials in different ways, for example, in imagery ways, in actions and have them • collate what they do know about the topic, draw a concept map of what they know in the different areas • say what questions they can answer. Give them time to think through the ideas by themselves, to allow some ideas to stimulate other linked ideas in their minds. Encourage them to make unexpected, distant links with ideas and to recode what they know from one form (eg imagery) to another (eg symbolic). Let them see that they are valued for what they know. Have them say what they don't know about the topic, unanswered questions they have. Have them say what they will do to learn about the topic, plan the route they might take, what they will do to manage and direct their learning. Help them deal with unrealistically high standards and goals for themselves, for example, how making mistakes can help them learn more in the future, the value of being 'partly right'

Activities to have GATS modify their goal and plan a pathway to the goal.	Use activities that encourage GATS to develop and record their plans for learning a topic: • the path they might follow, • the questions they will ask, • the materials they might need, suggest information sources they could use and how they will locate information. • when they might need to contact experts in the area.
Activities to have GATS learn new ideas in specific contexts	Use activities that encourage GATS to • think about the new ideas in a range of ways: verbally, intuitively, visualise the ideas, act them out to see the outcomes, make concrete or visual models of the ideas.. Allow them to show the rich set of links they have of the topic. Use the multiple ways of learning sheet to plan activities in each area. • note possible patterns, trends, program themselves by talking about the trends and to align what they know with the topic. • use a range of information sources about the topic, • interpret a new topic as problems to solve, ask their own questions about it, explore options, possibilities. say the questions they are pursuing at any time, trial ideas. • use both global 'big picture' and analytic 'bits picture' thinking; begin to learn a topic in a 'big picture' way, think in larger jumps, skip steps, reflect on what works for them, talk about the steps, gradually convert them to a bit by bit sequence, write them in more conventional ways, practise them but do fewer repetitions of an idea to learn it. • talk about their new knowledge. This helps them make links with and program their knowledge, to build on it, communicate new ideas and to link them with the conventional procedures their non-gifted peers are learning. • think by using analogy, compare and categorise. They can suggest possible analogies, compare their solution procedures with the conventional ones, note how they differ. • look for cause-effect or consequences • take account of the fact that GATS often do not need as much practise to learn new ideas and that allow them to decide when they have done sufficient practice examples. Allow their practice to lead to increased awareness of the procedure and its self-managed use • manage and direct their learning, work at their own pace, monitor their comprehension at any time and take remedial action if necessary with less external intervention. • show what they know about the new ideas in a range of ways and automatize the conventional forms. groups, to see what it is that the group values at any time and take this into account. often do not need much practise to learn new ideas • seek and use the appropriate corrective feedback. Give them corrective feedback that recognises the ideas they have in place and possible directions / options they have for working on next.

Activities to have GATS deepen and abstract what they have learnt.	Use activities in which the GATS
	• integrate the abstract, experiential and procedural aspects of the new ideas, review and consolidate them. They
	  • summarise, decontextualize the idea from specific tasks.
	  • discuss contextual aspects, real world situations in which they might use the ideas, imagine the idea in particular contexts.
	  • show the new ideas they have learnt in various ways.
	• elaborate and extend ideas through questioning, put their knowledge into categories, organize ideas into main/subordinate ideas,
	• look at the new ideas from various angles, different perspectives,
	• recode knowledge into different forms, eg., put imagery knowledge into scientific knowledge. This helps them get positive feedback for what they know.
	• express, communicate what they have learnt in conventional ways.
	• question the ideas they are learning. They can
	  • suggest the questions the ideas answer
	  • answer questions that direct them to infer; to reason about ideas, look for patterns.
	  • answer questions that ask them to generalise.
	Provide feedback that helps them modify their more abstract understanding.

Activities to have GATS invest positive emotion in the new knowledge**.**	Use activities in which the GATS • discuss how the new ideas interested them, have increased their curiosity. • discuss the value / usefulness of the new knowledge, how they could use the new ideas. • discuss how it was their ability as students that allowed them to learn the ideas at the level of complexity they did, they can successfully learn more about the topic. • discuss how learning the ideas will help them along their journey. • reflect on aspects of the topic; they record in a journal their experiences, their feelings about the ideas they are learning and questions they might like to ask about the topics. • see themselves as masters of the ideas, making the ideas work for them.
Activities to have GATS store what they have learnt in memory**.**	Use activities in which the GATS say • the new ideas they have learnt as concisely as possible • how they have changed what they already knew • how they might use the ideas in the future.
Activities to have GATS identify how they learnt.	Use activities in which the GATS • Say the 'self scripts' that they used to help them learn the topic. • Say what have they learnt about 'thinking like' ? What are the types of questions asked? • record the ways in which they learnt a topic, the thinking that worked for them**.**

Activities to have GATS see themselves making progress.	Use activities in which the GATS • Review, comment on their progress to their goals, review the knowledge they have gained, the questions they can now answer, the directions they can move in the future. • They can tick off on their journey through the topic, where they are now.
Activities to have GATS automatise what they have learnt.	Use activities in which the GATS • automatise what they have learnt in meaningful ways rather than by being taught rules. • generate the facts often, say them and use them in gradually more broadly • speed up recalling the ideas and using them and anticipate when they may need to use them in quizzes, draw network diagrams, concept trees of related ideas, • review the links between ideas, compress the ideas into a few 'chunks' of knowledge.
Activities to have GATS transfer and generalise the new knowledge	Use activities in which the GATS • analyse the new knowledge from a range of perspectives, for example, suggest higher order Bloom-type questions, de Bono 6 hats questions • explore how far it can be transferred, applied, generalised, show 'far transfer' of the ideas and generalise the new knowledge far beyond the context in which it was taught • link ideas in lateral, creative ways, for example, to operate intuitively, to give unexpected responses to questions • use imagination, fantasy and humour, show 'intellectual playfulness', explore an idea in depth, debate or argue an issue. • suggest the key questions their new knowledge answers, work on open-ended, questions that explore alternatives. "*What might we do here ?*" "*What do you think will happen ?* " You may follow up these questions with "*Why do you think that ?* " "*But what about .. ? Do you mean ?* • examine positive and negative aspects of the ideas; *What are good / bad things about using calculators a lot to do maths ?* • examine how the ideas might be used in the future; *What new things might calculators be able to do in the future that they can't do now ?* • examine how the ideas have changed what we know, how we do things.
Activities to have GATS organise what they have learnt for assessment.	Use activities in which the GATS • Practise aligning what they know with the tasks set and answering these. • decide how they will display their knowledge. Give them functional ways in which they can communicate their new knowledge • align what they know about a maths topic with the assessment format, for example, if the assessment tools are short answer tasks, are in verbal form. • discuss how they believe they will be expected to display the ideas in the future • work in small groups to write assessment questions, mock examinations for peers. • practise recalling the ideas.

The teaching procedures for each learning action are shown in the following table. The learning characteristics of gifted students for each action are shown in the left hand column. Relevant teaching procedures for fostering and directing this learning action are shown in the right hand column. The topic used to illustrate the teaching procedures is how oil is formed.

Teachers can use this framework to guide gifted and talented students for learning any topic. Key dialogue for learning each aspect is shown in italics.

Gifted students	Teaching procedures
need a challenge or reason for learning: they • learn well by having their knowledge challenged, by being able to frame up questions that they pursue. • are more likely to show intrinsic motivation to learn. They resist extrinsic motivational orientations. • are more likely to show deep motives for learning, to want to 'take ideas apart', question and extend them by linking with what they know. They often resist learning for superficial or achieving motives. • may be more difficult to motivate to learn ideas in areas that don't interest them initially.	Present the topic to be learnt as a challenge or problem to be solved. Show gifted students an aquarium with goldfish and plants and a container of oil. Ask "*What is the link between these ? What do these have in common ? How did this form ? Do you think the little fish and plants like this formed oil ? How long did it take to form ?*" Tell the students that fish like the goldfish form oil. How do they think it happens ? Allow the students to say what they think, possibilities. Ask questions that help them take their ideas apart and to analyse them. Encourage them to set goals in areas where they are not interested. Whenever you have students frame up goal for learning idea in a subject such as history, bring together the two key ideas - in this case oil and small animals and plants.
need to know where they will end up : they • learn well by forming an impression of where they will end up, see their goals.	Ask students to say what they will know / understand/ be able to do/ believe / when they have learnt the topic. In this case the students say that they will be able to explain how small marine animals and plants formed oil.

make links with and use what they know about the topic: they
 	
• have superior existing knowledge of a topic that is more differentiated and elaborated in a range of forms:
 	
  • verbal, abstract, 'semantic' forms (verbally gifted)
 	
  • imagery, experiential form (visual spatial gifted).
 	
  • procedural forms; kinaesthetic or 'action' gifted.
 	
  • scientific-mathematical form (math/ scientifically gifted).
 	
  • musical form; musically gifted.
 	
• process information faster and efficiently, show cognitive efficiency (e.g., memory span) (Saccuzzo, Johnson & Guertin, 1994), show higher efficiency in elementary processes (Geary & Brown, 1991) that determine more complex processes.
 	
• need to see that they will be allowed to manage and direct aspects of the learning, that they are valued for what they know and how well they can manage the learning.
 	
• are curious, good at questioning a topic or the ideas they will learn about.
 	
• need to have the opportunity to recode what they know to match the teaching.
 	
• often set unrealistically high standards and goals for themselves, self-evaluate and become self-critical..
	• To help them identify, collate and show in different ways what they know about how oil was formed, for example, they can draw a concept map of the key ideas, draw their imagery understanding, the actions they believe made it.
	
	• Give them more time to think through the ideas by themselves, to allow some ideas to stimulate other linked ideas in their minds.
	
	• Have them say what they will do to learn about the topic, plan the route their learning might take. Let they see that they have a role in managing and directing their learning.
	
	• Encourage them to be curious about how oil is formed, to question what they know about and to identify what they don't know about it, their unanswered questions, for example,
	
	  • *Why was it only small animals and plants that decayed to make oil ?*
	
	  • *Did different kinds of animals make oil of different quality ?*
	
	  • *Did the sand and silt that accumulated in the water have to be of a particular type / have a particular density range ?*
	
	  • *Did the water need to be in a certain temperature range ?*
	
	  • *How long did it take for the animal matter to decay ?*
	
	  • *Would there be oil forming in parts of the world now ?*
	
	• Help them deal with their often unrealistically high standards and goals for themselves. Let them see
	
	  • how making mistakes can help them learn more in the future
	  • that judging themselves harshly doesn't lead to best outcomes
	  • that they can deal with situations in which they believe their creativity is threatened
	  • how they may be putting unnecessary stress on themselves and how they can deal with this.
	
	• Help them set realistic standards and goals for themselves, see that they can learn better when they allow themselves to make mistakes be 'partly right'.

need to see a pathway to the goal: they learn well by forming an impression of where they will end up, see their goals	Encourage them to develop their own plans for learning about how oil was formed, the path they might follow, the questions they will answer, the materials they might need. They can decide when they might need to contact experts in the area, questions they might ask.

learn new ideas in specific contexts: they • know how to use their knowledge better. • learn in idiosyncratic ways, are not easily programmed externally and need to align what they know with the teaching. • ask questions spontaneously *How can I get from ...to .. ?* • explore possible options, trial ideas, interpret ideas as problems to solve. • use analogy, make comparisons well, think about ideas in different ways; for example, think intuitively, in imagery or action ways. • link and categorise ideas at a high level. • look for cause-effect or consequences. • often do not need much practise to learn new ideas. • often do not get the appropriate corrective feedback. • recall better from short term memory and use higher level organizational strategies. • prefer to use global wholistic thinking more than analytic sequential thinking. • show superior metacognitive knowledge, more able to monitor comprehension	Use teaching that encourages them to • challenge or question what they know about how oil was formed. The teaching can cause them to ask complex questions about their verbal, imagery or action knowledge, , for example, *Do you get oil of different quality from different types of vegetation or animals* ? You can use a range of information sources to initiate this challenge, for example, *What does this video tell you about how oil was formed that you didn't already know ? What questions does it answer for you ? What questions does it suggest you ask ?* The students can generate their own questions from this and seek the opportunity to answer them for themselves. They can suggest information sources they could use and how they will locate information. Have them plan how they will collect different sources of information. They can list the questions they think the teaching might answer, what questions they might be able to answer having learnt. This is to supplement or replace typical 'bit by bi sequential teaching. • interpret ideas as problems to solve, explore possible options, possibilities, trial ideas, interpret ideas as problems to solve. They say the questions guide their learning at any time. • think about the ideas in intuitive ways as they work through the teaching information, to visualise the ideas, act them out, for example, think about how animal and plant matter could form oil in different ways. • allows them to think in both global 'big picture' and analytic 'bits of picture' ways, to think more flexibly and to talk about possible ambiguities they see in the ideas. During learning, allow them to think in larger jumps, skip steps in their teaching, to do fewer repetitions of an idea to learn it. • think and reason about how oil was formed by using analogy, they can make concrete or visual models of the ideas, compare and categorise. Use cue questions if necessary to suggest possible analogies, learn how to communicate their new ideas in more conventional ways, to learn how to be structured or programmed by others in some contexts. Encourage them to reflect on, keep track of how they learn, what works for them. • work at their own pace. • look for cause-effect or consequences, practise. • take a greater role in managing and directing their learning, allow them to monitor their comprehension at any time and to take remedial action if necessary with less external intervention. • give them corrective feedback that recognises the ideas they have in place and possible directions / options they have for working on next.

	• Give students a range of ways of showing what they know about ideas. Many gifted students find it hard to display their knowledge in some formats because they haven't automatized them. They become frustrated because they can't show what they understand to teachers or peers. They also need to learn gradually how to 'read' and to sum up peer groups, to see what it is that the group values at any time and take this into account. They can use the framework below to convert the information, data to knowledge. See 2.3 below for teaching ideas here.
deepen what they have learnt; abstract it: they • link episodic, abstract and procedural aspects of idea. • review, consolidate what they have learnt. • decontextualize, summarize, organize, link with what is known, main/subordinate ideas. • elaborate and extend ideas through questioning. • look at ideas from different perspectives	Use teaching that encourages them to • link ideas in lateral, creative ways, for example, to operate intuitively, to give unexpected responses to questions, for example, *Why might you get oil of different quality from different types of vegetation or animals* ? Students can link the type of hydrocarbon with the animals that lived in an area. • use imagination, fantasy and humour at a high level, show 'intellectual playfulness'. Provide opportunity to explore an idea in depth, debate or argue an issue. have a well-developed memory, particularly for the areas of interest. • recode their new knowledge into different forms, eg., convert their new imagery knowledge in to scientific knowledge. This helps them to explore their new understandings from different perspectives and to get positive feedback for what they know. • consolidate and review explicitly what they have learnt, explore how far it can be transferred, applied, generalised. They can show new knowledge in language forms, in iconic forms, through action sequences, in symbolic ways, etc. • review, consolidate what they have learnt about how oil is formed, to link the episodic, semantic and procedural aspects of idea at once. • decontextualize, summarize, organize ideas into main/subordinate ideas, show the new ideas they have learnt in various ways, for example, in poster, comic strip, concrete model. • express, communicate what they have learnt about how oil is formed in conventional ways.

invest positive emotion in the new knowledge: they are assisting by having them invest positive emotion in the new knowledge.	Have then discuss • how the new ideas interested them, have increased their curiosity, • the value of the new knowledge, how they could use the new ideas and • how it was their ability as students that allowed them to learn the ideas at the level of complexity they did.
store what they have learnt in memory: they store what they have learnt in memory when they are more interested in the ideas.	Have them say • the new ideas they have learnt as concisely as possible. • how they have changed what they already knew. • how they might use the ideas in the future.
identify how they learnt: they talk about how they learnt the topic, the key learning actions they used. Many gifted students learn rapidly in idiosyncratic ways, rather than being programmed to think and it is useful for them to reflect on how they went about learning.	• Have them identify new self-talk, self scripts, ways of thinking in historical ways, in the domain of history that they could use in other areas of knowledge. *What have you learnt about 'being an historian ? What are the types of questions historians ask ? What are the types of knowledge historians pursue ?* • Have them keep a record of the ways in which they pursued the topic, the ways of thinking that worked for them. They can keep a diary of how they worked through the topic, say whether particular types of thinking strategies such as visualising worked**.**
see themselves making progress	Have them review the knowledge they have gained, the questions they can now answer, the directions they can move in the future.
automatise what they have learnt: • many gifted students automatise what they have learnt in meaning ways rather than through being taught rules. • they often do not automatise ideas by rote.	Have them review the links between ideas, try to compress the ideas into a few 'chunks' of knowledge**.**
transfer and generalise the new knowledge: they show far transfer and generalise the new knowledge far beyond the context in which it was taught	Have them • suggest the key questions their new knowledge answers. • analyse the new knowledge from a range of perspectives, for example, they formulate higher order Bloom-type questions, de Bono 6 hats questions. • engage in 'far transfer' of the ideas. See 2.5 and 2.6 below for ideas here.
organise what they have learnt for assessment purposes	Have them decide how they will display their knowledge. Give them functional ways in which they can communicate their new knowledge.

Helping gifted history learners elaborate the ideas in a range of ways

Students can be gifted in a range of knowledge areas. For an topic you are teaching, you can use activities that guide them to learn the new ideas in the various knowledge areas. The following frameworks show how this can be developed for the formation of oil and for teaching percentages.

Cultural-historical thinking Think about the ideas in historical – cultural ways. When did these processes begin to occur ? How long did they take ? When did man begin to mine oil? How did cultural factors make the mining of oil relevant or useful ?	**Affective thinking** Think about the ideas in emotional ways.	**Logico mathematical thinking** Think about the ideas in scientific ways. What are some of the key scientific concepts that are mentioned ? What scientific processes are involved ?
	The history of how oil was formed	
Verbal linguistic thinking Read the data re oil forming. Paraphrase and summarise it. Tell yourself the questions it answers. Interview an 'expert' about how oil was formed. What questions would you ask. You be the expert being interviewed. Prepare a 5 minute speech about how oil was formed. Make up six easy and difficult questions for another group about how oil was formed. Debate the topic "There is likely to be many still undiscovered oil reserves around the world.	**Imagery episodic thinking** Collect pictures, diagrams of how oil was formed. Visualise specific instances. Reflect on these, analyse specific instances. Note what they have in common. Draw diagrams that show how it formed. Develop an icon to represent the process.	**Action thinking** Think about the actions involved in forming oil. Build models of how oil was formed. Have students act out what could have happened to make oil. Have them act out the various changes. What are the key actions in forming oil ? If you wanted to make oil in a factory, how would you apply these actions ?

Learn new idea in particular cultural, social or historical contexts	*Link new ideas in scientific- mathematical ways*	*Link emotions/ feeling with new ideas*
How has evaporation been used in history ? (to obtain drinking water, for refrigeration) How is evaporation used in different cultures ? What problems does it cause ? How can communities control it?	Is there the same amount of water in a room when a dish of water evaporates? How has it changed? - same amount, change of state What causes evaporation ? What matches evaporation for solids ? Why / when do things evaporate ?	What feelings would you have if you evaporated (light-headed) How might liquids that are evaporating feel ?
Draw attention to the cultural, historical aspects of ideas	learn ideas in symbols, abstract, ideas, to think about them in a general way	the feelings attitudes linked with ideas

EVAPORATION

Link new ideas in words, in sentences, in more abstract ways	*Link new ideas in particular contexts and in images*	*Learn the actions that go with the new ideas*
Brain-storm ideas -- concept map ---->network map Paraphrase, summarise text that explains evaporation. An evaporating liquid is interviewed. What would it say ? Ask 6 hard questions about evaporation. Write a story / play "Adventures of a liquid evaporating" When else would you use the word 'evaporate' Discuss situations involving evaporation, what happens.	Imagine, draw, collect situations in which evaporation occurs * water on a dish * clothes drying on a line * petrol on the body of a car * vapour rising from sea * dry ice foaming. Draw a comic strip of petrol evaporating from body of a car Useful icons for evaporation ? Classify instances of evaporating. Make poster or snapshot of the ideas.	Make an action model of evaporation (for example, corks flying out of a shaken jar). Small groups of students act out a gas evaporating. Is there a reverse action to evaporating ? Acting out a gas evaporating; rising up, stretching, spreading out.
think about the ideas in words, paraphrase or summarise them, work on links between verbal concepts	Remind students to think about ideas in real-life contexts, visualise them	use actions to represent ideas, to imagine the ideas changing

The following framework shows the types of activities and questions students can be asked to build new ideas in each domain of knowledge :

Learn new idea in particular cultural, social or historical contexts	***Link new ideas in scientific- mathematical ways***	***Link emotions/ feeling with new ideas***
When was the idea first used ? Why did it arise ? What problems did it help solve ? What cultures are more likely to use the ideas now ? Are matching ideas used in other cultures ? Is idea 'taboo' in some cultures? Will the idea be used in future ? ?How has the idea changed with other changes for example, calculators	Convert one idea into another. Apply formulae, general procedures learnt Invent, write your own procedures for working out, solving the tasks / problems Prerequisite math knowledge for dealing with tasks / problems ? Categorise tasks/ problems in different ways. Decide when to use idea. Write formulae, general statements for data. Identify the assumptions, logic, on which idea is based Link idea with related math-scientific ideas Write idea in math- scientific language	What feelings would you have if you were the idea ? What feelings do you have about learning the ideas ? What feelings does the idea produce ? What feelings keep you learning/motivate you to learn the idea (curiosity, etc)
Draw attention to the cultural, historical aspects of ideas	learn ideas in symbols, abstract, ideas, to think about them in a general way	the feelings attitudes linked with ideas

Teaching an idea in each of the garden beds

Link new ideas in words, in sentences, in more abstract ways	***Link new ideas in particular contexts and in images***	***Learn the actions that go with the new ideas***
Develop ideas into a story. Brain-storm ideas ---> concept map--> network map. Discuss "What type of idea is it ? How is it like what I already know ?" Synonyms, antonyms. Slot idea into network map Verbalize the symbolism. Write article about idea for school magazine Think aloud working through tasks. What are useful things to say ? Teach peers to solve problems. Where does word come from ? Glossary Make up 6 difficult tasks Debate aspects of the idea.	Collect pictures, experiences, episodes, draw, situations in which people the idea is used/ appears Reflect on, analyse specific instances Construct, build models for the ideas. Discuss limitations of models Make videos of the ideas Draw a comic strip of the sequence of ideas, to show steps, etc. Draw diagram of ideas What do all instances share ? Invent icons of the idea Visualize, imagine new contexts in which ideas can be used.	'Do' the idea by acting on concrete and mental items. What action do you do ? Can you see simpler actions in the idea Act out symbolism Is there an opposite action to the idea as an action? Make up models to show the idea. What other actions are like the idea? What is special about the action ?
think about the ideas in words, paraphrase or summarise them, work on links between verbal concepts	Remind students to think about ideas in real-life contexts, visualise them	use actions to represent ideas, to imagine the ideas changing

How well does your teaching match how gifted learners learn ? Teachers need to evaluate the teaching procedures they use to check that they match how gifted and talented students learn. You can use the following set of criteria to review the extent to which your teaching fosters the learning characteristics of students who are gifted.

How often would you	Not at all	Some-times	Al ways
introduce ideas as real-life problems that students solve	❒	❒	❒
ask students to suggest questions the teaching might answer?	❒	❒	❒
have students guess particular outcomes and then check them ?	❒	❒	❒
use novelty ?	❒	❒	❒
use open-ended tasks in which the students frame up questions and an action plan ?	❒	❒	❒
use fantasy and imagination to develop ideas ?	❒	❒	❒
have students pursue spontaneously their own interests in maths ?	❒	❒	❒
have learners see where they are on their 'journey' through a topic ?	❒	❒	❒
provide them with a programme of topics ?	❒	❒	❒
help them see their learning pathway is predictable from what they know ?	❒	❒	❒
have learners describe / draw parts of their 'journey through a topic ?	❒	❒	❒
ask students to draw / talk about what they know about the topic ?	❒	❒	❒
remind students to link the new idea with what they know ?	❒	❒	❒
ask students to brainstorm topic	❒	❒	❒
ask students to collect everyday information about the topic ?	❒	❒	❒
have students ask questions about the topic?	❒	❒	❒
use co-operative sharing activities in which students share and pool their thoughts about the topic to be learnt	❒	❒	❒
have students recode imagery/ action knowledge into a verbal form ?	❒	❒	❒
use activities to automatise students' prerequisite knowledge ?	❒	❒	❒
respond emotionally to what they know about the topic ?	❒	❒	❒
say what they will do to learn the ideas?	❒	❒	❒
see that what they already know is useful and relevant ?	❒	❒	❒
act out the ideas they are learning ?	❒	❒	❒
visualise the new ideas by teaching them to use icons and then to form mental pictures for the ideas ?	❒	❒	❒
learn mental actions to match the physical actions ?	❒	❒	❒
talk about their changing knowledge of a topic ?	❒	❒	❒
show what they know first in familiar ways ?	❒	❒	❒
learn positive attitudes to the ideas they are learning ?	❒	❒	❒
integrate contextual, abstract, procedural and emotional aspects of ideas they are learning ?	❒	❒	❒
look at the new ideas from various angles	❒	❒	❒
put their knowledge of a topic into categories ?	❒	❒	❒
manipulate the conventional symbolism describing / talking about the new ideas?	❒	❒	❒
remind students to think about the ideas they are learning, reflect both on what they have learnt and how might the ideas be used in the future ?	❒	❒	❒
teach them to talk about the thinking they use while doing a topic ?	❒	❒	❒
have students assemble and add to their list of useful learning strategies ?	❒	❒	❒
teach them how to plan their way through tasks ?	❒	❒	❒
teach them to see possible 'danger areas, dead-ends in tasks ?	❒	❒	❒
at the end of a lesson review and say what they have learnt ?	❒	❒	❒
tick off where they are now on their journey through maths ?	❒	❒	❒
respond emotionally to the ideas they learn, discuss their feelings ?	❒	❒	❒
see the usefulness or value of the ideas ?	❒	❒	❒
value themselves as learners, see that it was what they did ?	❒	❒	❒
comment on how they are feeling while learning a topic ?	❒	❒	❒
see that curiosity and a positive attitudes to enquiry is valued ?	❒	❒	❒
attribute their success functionally ' ?	❒	❒	❒
see themselves as masters of the topic they are learning ?	❒	❒	❒
draw pictures to remind themselves of ideas they have learnt ?	❒	❒	❒
say what do the ideas remind them of ?	❒	❒	❒
think of things that can help them remember the idea ?	❒	❒	❒
speed up recalling the ideas and using them ?	❒	❒	❒

To produce an enquiry that GATS students may pursue for a topic you will teach To differentiate the teaching to accommodate the learning characteristics of GATS, we need to develop an enquiry that allows these students to develop further the topic we are teaching the regular class at any time. We need to elaborate the topic that we will teach as well as differentiating the teaching we will put in place. This topic needs to run in parallel with some of the regular classroom teaching for this topic.

A framework for analysing the topic is provided in the following:

Guideline for differentiating the topic for GATS	Application to the space concept
Analyse the topic that the regular students will be required to learn : This topic requires students to language of common 2-D and 3-D shapes and to categorise, identify a pattern.	The topic aims to help students recognise, describe and name common 2-D shapes such as right-angled and equilateral triangles and talk about them using conventional language
Try to identify more complex versions of the topic, for example • Question one or more concepts that underpin or shape an idea or topic. • Imagine / apply the ideas in different situations, at future times (whether they might be used / modified in the future)- aim to have students make far transfer	Analysing and talking about the properties of clusters of common 2-D shapes such as right-angled and equilateral triangles.
Frame up questions that relate to these ideas. Select questions that link back to the understanding of the class. To generate challenge tasks, bring together the two key ideas they need to learn. Develop activities that encourage GATS to • be intrinsically motivated to learn. • 'take ideas apart', question and extend them by linking with what they know. and to say what they think, possibilities. .	I want the students to think about the perimeter, angle properties and area of the clusters of triangles. I won't teach these properties directly but I would the students to research them and to synthesise their understanding.
Estimate / clarify what students may already know about the topic. You may need to have a set of tasks to see how much of the content you will teach to the class as a whole is already known by the GATS students.	Recognise triangles, discriminate them from other shapes.

<table>
<tr>
<td>Develop the idea initially in particular contexts first by unpacking the concept. Set up the activities so that students can research, analyse and evaluate each idea, make links with what they know. Work out activities that allow GATS to think
• creatively, to be intuitive, think in terms of possibilities, speculate, predict
• critically, to evaluate new ideas in terms of what they already know
• logically, to apply their existing maths knowledge of the topic
• by problem solving, to decide how they might trial a set of ideas, reflect on their trialing, gather data
• in terms of their purpose, unanswered questions
• by generalising, transferring, synthesising</td>
<td>Analyse and describe isosceles right angled triangles, first clusters of 2 triangles, clusters of 3 triangles and then , clusters of 4 triangles.
Link the area of clusters of triangles with areas of squares, rectangles.

Look for examples of polyabolos in squares in real world situations such as architecture, artwork, ornaments and jewellery, symbols. Why are they used in each type of situation ?</td>
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<td>Synthesise their new understanding. Use activities in which students
• identify and talk about shared patterns, generalise, look for rules and why they work
• synthesise, draw together or integrate aspects of the new ideas into a ‘big picture’.

Draw the principles together into a body of knowledge</td>
<td>Predict and compare the size of the squares and rectangles that can be made from pentabolos, tetrabolos and triabolos.

Solve word problems.
Compare patterns with other triangle clusters.</td>
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<td>Throughout the sequence use tasks that
• Have a balance between tasks that allow both convergent and divergent thinking.
• Are unusual in various ways and lead to unexpected outcomes
• Allow intrinsically motivated activity
• allow high task commitment
• allow,
• draw in various aspects of maths knowledge
• encourage the students t</td>
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<table>
<tr><th>To what extent do the tasks allow</th><th>little</th><th>Some</th><th>A lot</th></tr>
<tr><td>both convergent and divergent thinking ?</td><td></td><td></td><td></td></tr>
<tr><td>unexpected outcomes ?</td><td></td><td></td><td></td></tr>
<tr><td>intrinsically motivated activity</td><td></td><td></td><td></td></tr>
<tr><td>high task commitment</td><td></td><td></td><td></td></tr>
<tr><td>a high level of student initiative</td><td></td><td></td><td></td></tr>
<tr><td>various areas of maths knowledge</td><td></td><td></td><td></td></tr>
<tr><td>creative / intuitive/ divergent thinking about maths ideas ?</td><td></td><td></td><td></td></tr>
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<td>Report, share and display their new knowledge</td>
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Describe what you want as a content outcome for the GATS: for the GATS to know about the side, area and angle properties of sets of triangles, to transform mentally sets of triangles and to synthesise the sets of triangles into other geometric shapes.

Content	Thinking skills : how will the students think about the ideas ?	Research skills and resources ?	How students will show what they have learnt
Patterns, trends in the side, area and angle properties of sets of triangles and how these link with other geometric shapes	Plan, trial, analyse, evaluate, compare, mentally rotate and translate shapes, synthesise		GATS show what they have learnt about polyabolos and polyequilats in a poster, a power point presentation, a set of games they teach their peers.

Fostering a learning climate for teaching gifted and talented learners

The appropriate classroom climate is important for optimizing gifted and talented learning. The learning characteristics and profiles of these students indicates the optimal aspects of a positive climate. Some of these are shown in the following table.

Encourage students to learn spontaneously.	Help them learn to deal with boredom. Where this arises, • help them see open-ended aspects of the ideas • encourage them to teach you about the ideas • try to make up games involving the ideas
Provide opportunity for the self-driven learning	• foster interest in problem solving contexts such as conservation, population change, climate change, waste disposal • encourage student selection of learning materials • encourage students to both produce and consume of new ideas • encourage communication with similar-minded students
Increase student awareness of the range of available resources	• Internet, data bases, computer, library • teach them how to access sources in community, for example, business, interest groups (for example, historical societies), specialist scientific institutions (zoo, museum, marine societies), cultural institutions (National Gallery)
Foster students' interest in others who were / are gifted	These students may not find suitable role-models in the peer group. Help them • see they are not alone • see options, how others dealt with the types of problems they face Biographies of gifted scientists, writers, artists can provide support.
Encourage learning outside of school, work with similar thinking peers who can be models	Examples • debating • drama groups, dance, ballet • sporting groups • pen pals, Internet pal
Help them keep their sensitivities in perspective.	They often show an advanced 'moral conscious'. Although their logic is adequate here, their lack of experiences limits the options that they can see for themselves or others. They may have difficulty resolving inner conflicts, unsure of themselves.
Help students understand their giftedness	They may not value their exceptional abilities, know how to show what they know so that it fits with peer expectations and feel different and alienated because they don't get the necessary positive affirmation but not understand why. They need to know that • not all students learn in the same way, although some people might think they should • they may be strong in some areas but not in others • some peers may not understand what they say or know
Help them improve their peer group social interaction skills	They may have difficulty identifying with a peer group, 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) and have difficulty communicating with same-age peers because of interest difficulties, while older children find them emotionally immature. They seem 'the odd one out', experience loneliness and isolation and not feel part of any group. They are often sensitive to rejection by others and over-conform in the peer-group so that they do not appear different. They may • want to dominate peer groups and group interactions and to direct group activities • be less carefree and easy-going as class peers but instead are more serious. • have difficulty understanding and valuing the learning of others, be irritated by class peers who do not understand the ideas at the same depth. • lack confidence in peer interactions, 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, You can help them • see what they do have in common with peers • learn more effectively in peer group, set up situations in which they engage in group problem-solving and sharing activities • learn the skills necessary for joining in peer group activities • understand that not all children think in the same way • learn how to show peers what they know in acceptable ways
Help them extend	• teach students different types of questions to ask about set topics

and integrate their knowledge	• help them learn ways of researching topics of interest, for example, • encourage them to investigate real problems in everyday life • encourage them to see tasks as open-ended challenges provide suitable role-models for learning; mentors, Night of Notables.
Gifted students manage their learning effectively.	Help them use their independence as learners in functional ways. Present ideas as challenges or problems. Students generate their directions for pursuing them. The teaching can • give learners increased opportunity to make decisions about what and how they will learn and how they will manage the learning • allow to learn independently and to direct their learning, to have time to operate independently • teach students to improve how they learn, Encourage them to say how they went about thinking and learning.
These students often show uneven rates of development.	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.

Differentiating any topic you will teach using the gifted teaching framework

You can use the teaching framework to guide the learning of any gifted and talented learner or group of students. The framework below provides a sequence of 'cues' and 'prompts' that you can use to differentiate the teaching for each phase of knowledge enhancement.

Instructional recommendations for teaching GATS	Sample activities for teaching a topic
Activity to challenge the knowledge of GATS, to frame up questions that they pursue. Use activities that encourage GATS to • introduce new ideas as real-life problems students solve • ask students to suggest questions the teaching might answer and what they think the answers are • present ideas that don't fit / clash with what students know. • have students predict outcomes and then check them. • use novelty. • give open-ended problems for which students frame up questions and action plans for solving them • use fantasy and imagination • have students invent problems, share with peers and discuss solutions. • use technology to introduce problems to be solved. To generate challenge tasks, bring together the two key ideas they need to learn. At this point provide activities that encourage GATS to • be intrinsically motivated to learn. . • 'take ideas apart', question and extend them by linking with what they know. and to say what they think, possibilities.. .	
Activities to have GATS form an impression of where they will end up, see their goals, frame up action plans for solving them. Have GATS • see what the outcome / solution will be like, • see where they are on their 'journey' through a maths topic, • where they are going next, negotiate the next part of their 'journey through ……'. Encourage GATS to • set goals in areas where they are not interested. • be intrinsically motivated to learn	
Activities to help GATS make links with and use what they know re topic: Use activities that encourage GATS to Present the stimulus materials in different ways, for example, in imagery ways, in actions and have them • collate what they do know about the topic, draw a concept map of what they know in the different areas • say what questions they can answer Give them more time to think through the ideas by themselves, to allow some ideas to stimulate other linked ideas in their minds. Encourage them to make unexpected, distant links with the ideas and to recode what they know from one form (eg imagery) to another (eg symbolic). Let them see that they are valued for what they know. Have them say what they don't know about the topic, unanswered questions they have Have them say what they will do to learn about the topic, plan the route they might take, what they will do to manage and direct their learning.	

Help them deal with unrealistically high standards and goals for themselves, for example, how making mistakes can help them learn more in the future, the value of being 'partly right'	
Activities to have GATS modify their goal and plan a pathway to the goal. Use activities that encourage GATS to Encourage them to develop and record their plans for learning a topic, • the path they might follow, • the questions they will ask, • the materials they might need, suggest information sources they could use and how they will locate information. • when they might need to contact experts in the area	
Activities to have GATS learn new ideas in specific contexts Use activities that encourage GATS to • think about the new ideas in a range of ways: verbally, intuitively, visualise the ideas, act them out to see the outcomes, make concrete or visual models of the ideas.. Allow them to show the rich set of links they have of the topic. Use the multiple ways of learning sheet to plan activities in each area. • note possible patterns, trends, program themselves by talking about the trends and to align what they know with the topic. • use a range of information sources about the topic, • interpret a new topic as problems to solve, ask their own questions about it, explore options, possibilities. say the questions they are pursuing at any time, trial ideas. • use both global 'big picture' and analytic 'bits picture' thinking; begin to learn a topic in a 'big picture' way, think in larger jumps, skip steps, reflect on what works for them, talk about the steps, gradually convert them to a bit by bit sequence, write them in more conventional ways, practise them but do fewer repetitions of an idea to learn it. • talk about their new knowledge. This helps them make links with and program their knowledge, to build on it, communicate new ideas and to link them with the conventional procedures their non-gifted peers are learning. • think by using analogy, compare and categorise. They can suggest possible analogies, compare their solution procedures with the conventional ones, note how they differ. • look for cause-effect or consequences • take account of the fact that GATS often do not need as much practise to learn new ideas and that allow them to decide when they have done sufficient practice examples. Allow their practice to lead to increased awareness of the procedure and its self-managed use • manage and direct their learning, work at their own pace, monitor their comprehension at any time and take remedial action if necessary with less external intervention. • show what they know about the new ideas in a range of ways and automatize the conventional forms. groups, to see what it is that the	

group values at any time and take this into account. often do not need much practise to learn new ideas • seek and use the appropriate corrective feedback. Give them corrective feedback that recognises the ideas they have in place and possible directions / options they have for working on next.	
Activities to have GATS deepen and abstract what they have learnt. Use activities in which the GATS • link episodic, abstract and procedural aspects of idea • elaborate and extend ideas through questioning, put their maths knowledge into categories, organize ideas into main/subordinate ideas, • look at the new ideas from various angles, different perspectives review, consolidate the new idea and integrate the abstract, contextual and procedural aspects of. They • summarise, decontextualize the idea from specific tasks, suggest a procedure or a formula that covers the specific instances. • discuss contextual aspects, real world situations in which they might use the ideas, imagine the idea in particular contexts. • show the new ideas they have learnt in various ways, for example, in poster, comic strip, concrete model • recode knowledge into different forms, eg., put imagery knowledge into scientific knowledge. This helps them get positive feedback for what they know. • express, communicate what they have learnt in conventional ways, show new knowledge in symbolic maths language. • question the ideas they are learning. They can • suggest the questions the ideas answer • answer questions that direct them to infer; to reason about ideas, look for patterns. • answer questions that ask them to generalise. • work in groups to learn the new ideas. Use group learning in which students • co-operate to solve problems, • write problems and mock tests for other groups of students, • share their ideas, discuss ideas with peers, work in groups to decide what questions might be useful to ask about a topic to be learnt, • take turns to be the teacher in explaining or justifying an idea, suggesting how ideas occur in everyday life or in other cultures • engage in reciprocal teaching procedures for learning new maths ideas . Provide corrective feedback that helps them modify their more abstract understanding of ideas	

Activities to have GATS invest positive emotion in the new knowledge. Use activities in which the GATS • discuss how the new ideas interested them, have increased their curiosity. • discuss the value / usefulness of the new knowledge, how they could use the new ideas. • discuss how it was their ability as students that allowed them to learn the ideas at the level of complexity they did, they can successfully learn more about the topic. • discuss how learning the ideas will help them along their journey. • reflect on aspects of the topic; they record in a journal their experiences, their feelings about the ideas they are learning and questions they might like to ask about the topics. • see themselves as masters of the ideas, making the ideas work for them.	
Activities to have GATS store what they have learnt in memory. Use activities in which the GATS say • the new ideas they have learnt as concisely as possible • how they have changed what they already knew • how they might use the ideas in the future	
Activities to have GATS identify how they learnt. Use activities in which the GATS Say the 'self scripts' that they can use to help them learn the topic. Have them discuss whether visualising or verbalising helped. Say what have they learnt about 'being / thinking like' ……. ? What are the types of questions asked? Keep a record of the ways in which they went about learning a topic, the ways of thinking that worked for them. They can keep a diary of how they worked through the topic, say whether particular types of thinking strategies such as visualising worked**.**	
Activities to have GATS see themselves making progress. Use activities in which the GATS Review, comment on how they are progressing to their goals, review the new knowledge they have gained, the questions they can now answer, the directions they can move in the future. They can tick off on their journey through the topic, where they are now.	
Activities to have GATS automatise what they have learnt. Use activities in which the GATS • automatise what they have learnt in meaningful ways rather than through being taught rules. • generate the facts often, say them and use them in gradually more broadly • speed up recalling the ideas and using them and anticipate when they may need to use them in quizzes, rapid exposure to ideas, draw network diagrams, concept trees of related ideas,	

• review the links between ideas, try to compress the ideas into a few 'chunks' of knowledge**.**	
Activities to have GATS transfer and generalise the new knowledge. Use activities in which the GATS • analyse the new knowledge from a range of perspectives, for example, suggest higher order Bloom-type questions, de Bono 6 hats questions • explore how far it can be transferred, applied, generalised, show 'far transfer' of the ideas and generalise the new knowledge far beyond the context in which it was taught • link ideas in lateral, creative ways, for example, to operate intuitively, to give unexpected responses to questions • use imagination, fantasy and humour, show 'intellectual playfulness', explore an idea in depth, debate or argue an issue. • suggest the key questions their new knowledge answers, work on open-ended, questions that explore alternatives. "*What might we do here ?*" "*What do you think will happen ?* " You may follow up these questions with "*Why do you think that ?* " "*But what about .. ? Do you mean ?* • examine positive and negative aspects of the ideas; *What are good / bad things about using calculators a lot to do maths ?* • examine how the ideas might be used in the future; *What new things might calculators be able to do in the future that they can't do now ?* • examine how the ideas have changed what we know, how we do things.	
Activities to have GATS organise what they have learnt for assessment. Use activities in which the GATS • Practise aligning what they know with the tasks set and answering these. • decide how they will display their knowledge. Give them functional ways in which they can communicate their new knowledge • align what they know about a maths topic with the assessment format, for example, if the assessment tools are short answer tasks, are in verbal form. • discuss how they believe they will be expected to display the ideas in the future • work in small groups to write assessment questions for peers, make up mock examinations. • practise recalling the ideas.	

Task 6 Apply the instructional framework above to a topic that a classroom teacher may teach at the primary or secondary level.

Implications for teaching gifted and talented learners learning

This model suggests that learning can vary in a range of ways. We can use it to develop a framework for integrating the characteristics of gifted and talented learners :

- how they learn : the specific learning processes they implement.
- what they learn: their learning outcomes.
- why they learn : characteristics of their motivation to learn and learning style.
- their interpersonal interactions during learning, cultural influences on learning
- their self-perceptions and self efficacy as learners
- the comparative rate of development of their knowledge overall.

Encourage students' spontaneous pursuit of knowledge. Help them learn to deal with boredom. This may lead to disengagement form learning, poor study habits and a lack of interest in education. Where this arises,

- help them see open-ended aspects of the ideas
- encourage them to teach you about the ideas
- try to make up games involving the ideas

Provide opportunities for the self-driven aspects of pursuing knowledge.

- foster interest in problem solving contexts such as conservation, population change, climate change, waste disposal
- encourage self-selection of learning materials
- encourage students to be both producers and consumers of new ideas; they
  - consume or use other people's ideas
  - produce their own, add new ideas

  Help them to understand the distinction between them and how they need both.
- encourage communication with similar-minded students using the Internet.

Help students become aware of the range of resources available for doing this;

- Internet, data bases, computer, library
- teach them how to access sources in community, for example, business, interest groups (for example, historical societies), specialist scientific institutions (zoo, museum, CSIRO, marine societies), cultural institutions (National Gallery)

Assist with 'information organising' as well as 'information providing'.

- Foster students' interest in others who were / are gifted in various ways. This can help them
- see they are not alone
- see options, ways that others used to deal with the types of problems that they might face

Reading or seeing the biographies of gifted scientists, writers, dancers, artists, etc can provide important support.

Involve them in situations outside of regular school in which they can extend their knowledge and work with peers who think in similar ways and who can provide models, for example

- debating
- drama groups

- dance, ballet
- sporting groups
- pen pals, Internet pal

Help them keep their sensitivities in perspective. They often show an advanced 'moral conscious'. Although their logic is adequate here, their lack of experiences limits the options that they can see for themselves or others.

Help students understand their giftedness
- not all children need to learn in the same way, although some people might think you should
- they may be strong in some areas but not in others
- some children, peers, may not understand what they say or know.

Help them improve their peer group social interaction skills.; help them
- see what they do have in common with peers
- learn more effectively in peer group, set up situations in which they engage in group problem-solving and sharing activities
- learn the skills necessary for joining in peer group activities
- understand that not all children think in the same way
- learn various ways of showing their peers what they know in acceptable ways

Help them extend and integrate their knowledge
- teach students different types of questions to ask about set topics

- help them learn ways of researching topics of interest, for example,
- encourage them to investigate real problems in everyday life
- encourage them to see tasks as open-ended challenges
- provide suitable role-models for learning, for example, mentors, Night of the Notables.

Help them deal with their 'mental energy'. These children are mentally energetic; they can become totally absorbed or focused in an idea or activity, leading to the "Just A Minute" syndrome.

Gifted students manage their learning effectively. Help them use their independence as learners in functional ways. Present ideas as challenges or problems. Allow small groups to generate their directions for pursuing the challenge or problem.
The teaching can
- give learners increased opportunity to make decisions about what and how they will learn and how they will manage the learning
- allow to learn independently and to direct their learning, to have time to operate independently
- teach students to improve how they learn,

Encourage them to say how they went about thinking and learning.

Task 7 Develop a checklist for assessing the extent to which a teaching unit meets the needs of gifted students in regular classrooms.

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