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Teaching gifted students: A knowing and thinking-based framework for differentiation

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Background and introduction

Catering for students who are gifted and talented in classrooms is emerging as a priority focus for many schools. Inclusive provision includes protocols for identifying these students and for implementing effective learning opportunities. This paper examines options for this provision. It is referenced on the assumption that such provision is most effective when it is informed by how these students know and think.

In an earlier 'companion piece' to this paper (Munro 2013), I described what gifted knowing and learning looks like in the classroom. That earlier paper showed how, when exposed to teaching, these students learn by forming intuitive theories about the topic. They do this by spontaneously extending and inferring from the teaching ideas. They form either an inferred pattern or a 'big picture' understanding of the topic, which they can test or investigate and, as a consequence, modify their knowledge of it. From this they form enhanced meaning networks of the topic.

These types of understanding of the topic differ in their quality from those formed by regular students. They contain a wider range of component meanings, many of which are not specified in the teaching information. They are organised into the personal theories noted earlier with details, key ideas and overarching 'big ideas'. The understanding has unique characteristics that lead to creative or innovative perspectives and outcomes. It includes possibilities or options that can guide the students' further investigation and evaluation of them. Because of these features, such types of understanding were described as 'expert+'

This paper uses this model to develop a framework for teaching these students in the regular classroom. It examines procedures both for identifying instances of these types of understanding and for educational provision for them.

Section One

Identifying gifted and talented knowing and thinking in the classroom

The identification process needs to identify students who can generate these types of understanding independently and spontaneously, across the range of domains in which they learn. It looks for evidence that students can do this when exposed to the range of life experiences and interactions.

Teachers and schools become aware in various ways that a student may be gifted and talented. The identification process in the classroom context can be triggered through:

- group assessments – for example, on-demand literacy testing of a group may lead to some students showing unexpectedly advanced comprehension outcomes;
- regular classroom learning-teaching interactions – when individual students, for example, display atypical, advanced interpretations of topics, or ask unexpected questions;
- learning-teaching interactions outside of the classroom and in students' self-initiated learning activities – for example, in the performing arts; and/or
- parent reporting.

Educators systematically under-identify culturally and linguistically diverse students as gifted

Schools and teachers need to be ready to respond to these initiating events by implementing a formal identification procedure. How they do this depends on their purposes for identification and what they want to know as a result of it.

Schools seek to identify gifted and talented students for multiple reasons, including to

- understand how these students think and know, to compile a learning profile for them, to plan appropriate teaching provision, or to identify entry-level knowledge for a topic;
- implement support and intervention for gifted underachievers;
- monitor the learning progress of gifted students;
- deal with social and interaction issues; and
- inform and clarify decisions made about them.

Schools need to ensure that the procedures they use match their reason/s for identification. Passow and Frasier (1996) recommend that the identification protocol meets various criteria. The protocol should

1. recognise the agreed nature of gifted and talented knowledge, its multiple forms and its domain specificity (for example, verbal, mathematical, artistic and musical);
2. allow individual students to display optimally their knowledge, dispositions and attitudes, and ways of thinking, in ways that are judged to be 'fair and equitable', and to be most appropriate for students from a range of cultures and experiential backgrounds;
3. target both what students know at any time and how they think;
4. be sufficiently objective – the display of student behaviours is independent of the assessor and its interpretation is sufficiently 'transparent'; and
5. cover equitably the multiple types of high achievement, for example, both schoolhouse and creative giftedness and the six profiles noted by Betts and Neihart (2010).

The protocol also needs to recognise that students can show gifted knowing in a range of ways, and that identification practices can be exclusive and preference some students. Educators systematically under-identify culturally and linguistically diverse students as gifted (Ford, Orantham and Whiting, 2008).

Some students, for example, perform poorly on paper-and-pencil tasks and display their knowledge in authentic problem solving tasks. Some do not perform well on tests referenced in cultures other than their own. Some learning and/or cognitive styles do not match the task context (for example, gifted learners who have literacy learning difficulties and those whose thinking does not match multiple-choice formats). Some may have test anxiety, or low academic motivation or engagement in formal assessment contexts.

Dialogue about identification often uses the concepts 'potential', 'aptitude' and 'ability'. These are estimated by assessing various aspects of what students know.

To take account of cultural differences and environmental contexts, Passow and Frasier (1996) recommend that identification take account of

- a concept of giftedness that is sufficiently broad to reflect 'multifaceted, multicultural, multidimensional perspectives' (p 199);
- the fact that while core attributes of giftedness may exist across cultures, the behaviours through which they are displayed may vary (Frasier, 1989);
- variability within a culture and the need to avoid stereotypes and characterisations; and
- multiple criteria and non-traditional measures (other than/as well as intelligence and achievement tests) – for example, observing gifted learning and knowing, noting how students interpret and respond to challenges raised in the teaching (Passow, 1986).

Section Two

A multi-phase systematic identification protocol

An effective identification process seeks evidence of enriched, differentiated knowledge; characteristic ways of thinking and approach to learning; and a range of associated affective factors (Subotnik and Jarvin, 2005) – such as high-level intrinsic motivation for excellence; a character/temperament dimension that includes perseverance; and persistence, an emotion dimension that includes enthusiasm, cognitive curiosity, commitment and personal standards and norms of intellectual activity and creativity.

A convenient approach to data collection and decision making regarding identification is the multi-phase systematic assessment sequence, as follows (Lidz and Macrine, 2001).

'First phase' screening procedures

'First phase' screening procedures examine the student's past capacity to display gifted and talented capacity to learn, to use above-average reasoning and learning abilities, and to show positive attitude to learning. This involves multiple screening measures, including

- teacher/school rating of the student's past learning characteristics (reasoning and thinking patterns, such as rapid thinking, ability to keep track of several ideas, lateral, big-picture divergent thinking, vocabulary and memory), motivational characteristics (intrinsic motivation to learn, spontaneous enquiry, self regulation, persistence in completing tasks and independence of learning) and display of creative outcomes, (evidence of lateral thinking and production of creative outcomes);
- assessment of past academic learning capacity in conventional areas of study;
- parent referral information regarding the student as a gifted leader – parents complete a questionnaire that permits them to 'tell the gifted story' in contexts beyond school and provide information that may not be known to teachers and peers;
- student self perceptions and the opportunity to 'tell their gifted story' in contexts both within and beyond school;

- collections of the student's earlier learning outcomes in portfolios – which could include school and extracurricular outcomes such as literature or music, art or sculpture, objects they had made and collections. These are evaluated in terms of what they indicate about the student's capacity to creating, apply and transfer knowledge.
- screening procedures for identifying gifted and talented outcomes in the visual and performing arts, dance, drama/theatre – for example those procedures published by the Ohio Department of Education (2003). This handbook provides a range of assessment procedures, including a rubric for scoring visual art, music audition/performance, dance audition/performance and drama/theatre audition/performance, for grades K-12. It also provides a visual and performing arts 'gifted nomination' form and visual and performing arts student profile sheets.

Commercial scales for first phase identification include the Renzulli-Hartman Scales for Rating Behavioral Characteristics of Superior Students (Renzulli, et al, 1976) and the Gifted and Talented Evaluation Scales (GATES) (Gilliam, Carpenter and Christensen, 1996). Yang (2009) provides a useful analysis of first phase instruments.

The data from the various sources can be collated and integrated into a 'gifted knowledge screening profile' for each student. These can be ranked and used to select students for further consideration.

'Second' or 'in-depth' phase identification procedures

'Second phase' procedures examine the current knowing and thinking of possibly gifted and talented students. A key aspect of this phase is that the 'possibly gifted' students can use the tasks to show all that they know and believe about one or more topics, and what they can do. The task allows them to 'take us on a journey through' their understanding and skill.

Standardised testing, particularly when it is intended for use with non-gifted students in the age range, will not allow them to do this. It allows you to identify students who score at or above the 90th, 95th or 99th percentile. It does not necessarily tell you all that a student knows about a topic, her/his unanswered questions or her/his capacity to use it.

The tasks at this phase need to take account of the multiple forms of gifted knowing and understanding, for

- those who learn faster – who infer, 'see the big picture', select, link and organise the main and subordinate ideas in the intended ways; and
- those learn differently – who form spontaneously a broader understanding that 'goes beyond' the teaching; and who infer and make links with ideas that they know but which are not mentioned in the teaching.

This phase uses tasks that assess through both convergent 'closed' tasks and divergent 'open tasks', to examine

- the number and types of ideas that students can manipulate at any time;
- the breadth of their ideas;
- the 'laterality' of the links they make;
- the number of unexpected but reasonable links;
- the types of propositions they can manipulate; and
- the extent to which they can transfer a proposition by analogy and generalise it.

It needs to take account of different students showing these multiple forms in particular domains, for example, verbal, mathematical-scientific, visual-imagery, musical and artistic domains.

Divergent assessment tasks, such as creative problem solving, are increasingly being used internationally to identify gifted and talented learners, for example by Sternberg and colleagues (Hedlund et al, 2006). They

tap abilities separate from those measured by traditional intelligence or ability tests (Sternberg et al, 2001).

This phase uses both group and individual tests and tasks in the following areas.

Assessment of academic learning capacity and thinking

Examples of this assessment include fluid reasoning using Raven's Standard Progressive Matrices, and group verbal and quantitative reasoning scales, such as the ACER Tests of Learning Ability (TOLA) and Verbal and Non-Verbal Reasoning Test Series.

Individual evaluations of general ability are often seen as more accurate measures. Tests such as the Wechsler Intelligence Scale for Children IV (WISC IV) and the Stanford Binet Intelligence Test (Fourth Edition) (SB-FE) indicate whether a student is gifted in the verbal or nonverbal domains (or in both) and in information processing and short-term memory. Such data can be collated for each student.

These scales are limited as measures of giftedness, in that they measure convergent thinking over divergent or open-ended thinking. These students often find the tasks difficult, because they interpret them in more complex ways than their peers. They may delay giving an answer because they think the correct answer is too obvious and not the required one.

IQ is limited as a defining concept. These tests do not test all aspects of intelligence. Giftedness includes more than general intelligence and specific academic ability. It is domain specific and cannot be accounted for by umbrella IQ. Factors in addition to general knowledge, including non-cognitive and socio-affective variables and experiences can influence potential. Conceptions of intelligence vary between cultures and what each culture values.

Assessment of specific academic aptitude in a domain

This includes quantitative and spatial reasoning for mathematical giftedness and verbal reasoning. Examples of verbal reasoning include the ability to

- transfer familiar propositions to unfamiliar contexts or integrate two known propositions in unfamiliar contexts, for example: *'How might a person's digestive system change with a trend to eating more pre-cooked packaged foods?'*
- analogise using verbal propositions, and note the types of relationships for which a student can analogise. For examples, finish these: *'Humour is to comedy as sadness is to ……..'; or 'A river is to a water wheel as an electric current is to a ……..'.*
- infer reasonable cause and effect. For example: *'Explain why the climate of Australia is different from the climate in England'.*
- comprehend nonliteral language, such as metaphors, similes and figurative statements. For example: *'What does: "Many little drops make a shower" mean?'*
- use verbal logic and reason in abstract verbal propositions. For example: *'Frank is older than Bill and Bill is older than Jack. Jack is …….. Frank.'*
- note the types, number and complexity of verbal propositions about which the students can reason. An example is: *'Which two of these sentences together prove that Mr White has a dog?'*
  - *A. All people in Optown love pets.*
  - *B. All people in Optown have dogs.*
  - *C. Mr White buys cat food.*
  - *D. Mr White lives in Optown.*

These tests are frequently 'off-level', above-level or 'out-of-grade-level'; they are normed with older regular students, 2–5 grade levels above that of the student. This allows you to examine the development of a student's knowledge or skill beyond her/his age/grade level. They are useful when the assessment tasks lie on a learning continuum in a domain. They spread the scores of students who would be at the top of a grade-level test. They indicate the type of teaching that is more likely to challenge the student.

Assessment of achievement

This includes literacy, mathematics (for example, using NAPLAN) and other academic domains and areas. Again you would use 'off-level', above-level or 'out-of-grade-level' procedures.

Assessment of the breadth of vocabulary

This includes recognising and recalling the meanings of verbal concepts, indicating similarities and differences in meaning between two or more verbal concepts, and recalling a range of verbal concepts for a topic.

Assessment of performance and authentic outcomes

These outcomes are generated or displayed in real-life contexts, often over an extended period. Examples include writing poems, books and plays, building bridges, planning community developments or monitoring traffic flow, producing unique Web pages and making, marketing and selling a product, or inventing things, such as games. Performances include conducting research, presenting findings or performing a play or music, or playing sport. The assessment here is embedded naturally in the learning context. The outcomes can be included in portfolios.

These tasks allow students to 'tell/show the story' of their gifted understanding, knowing and thinking in ways that are appropriate to their culture. They require problem solving in real-life contexts, using 'big picture' thinking about complex interrelationships, often in an interdisciplinary way. They meet challenges and problems not found in text books.

Scoring authentic assessment tasks is complex. You use a range of scoring techniques, for example rubrics that examine evidence of

- using higher-level thinking – including analysis, synthesis, evaluation and creativity, as well as skills in organising and using information, intrinsic academic motivation, task commitment and focus;
- attitudes and social skills – for example, attitudes toward cultural diversity, scientific attitudes, and interviewing individuals and groups.

You need to devise scoring criteria before a particular product can be assessed.

Assessment through contextual/social problem-solving (CPS)

Contextual problem solving involves ill-defined 'real-world' problem scenarios that lack a single solution path, for which the solution may not be obvious or readily available. An example is shown in Box 1.

Box 1. 'iPods are bad for healthy hearing'

> Listening to your iPod at moderate volumes for even a moderate amount of time can permanently damage a person's hearing. A neuroscientist from McGill University, Daniel Levitan says that iPods damage people's hearing. When the average teenager listens to an iPod, the sound level is like what you would hear if you were standing on the tarmac when a 747 aircraft takes off.
>
> The sound from the iPod damages the hair cells in the ear. Those listening lose their ability to detect high-frequency sounds. Once the cells have been damaged by loud noises, they are unlikely to recover. The iPod is creating generations of hearing-impaired individuals. Many people do not know how bad it would be to lose their hearing.

The students respond to the problem scenario by unpacking it in terms of the guiding questions shown in Table 1.

Their responses to each criterion are assessed in terms of two dimensions, which are

1. the number of ideas mentioned; and
2. the extent to which the response shows evidence of inference and far transfer, versus literal comprehension.

The responses of gifted students include

- a higher number of relevant ideas, with ideas showing evidence of details organised around a big idea; and
- inferential thinking – that is, containing ideas not mentioned or expected in the scenario.

Table 1. Guiding questions

Criteria for evaluation: How well does the participant's solution identify and describe …	Cue questions that will be used to guide each student's response
1. the main problem?	Write down what you think the problem is, in your own words.
2. a solution?	What would the situation look like after the problem has been solved? What would you hope to achieve?
3. the actions needed to solve the problem?	What do you think you would need to do to solve the problem? List as many things as you can think of.
4. the information/assistance they would need to solve the problem and the questions they could ask?	To do these things, what do you need to know? Say these as questions to which you want answers.
5. obstacles and difficulties in implementing their solution?	What difficulties do you think you would face? List as many as you can.
6. ways of overcoming them?	What could you do to overcome these difficulties?
7. the people likely to be affected by your problem solving activity?	You have solved the problem. Which other groups of people may be affected by this? Some people may have been affected in a good way. Others may be affected in a bad way.
8. how the solution would affect the community?	What effect do you think your actions would have on the local community?
9. how to monitor the effectiveness of the solution?	What could you do to help you see whether your solution was working?

Contextual problem solving gives one type of task that is used increasingly to identify gifted and talented learners (Sternberg, 2005). It focuses on the quality of students' ability to think about an issue and to use open-ended divergent thinking and creativity, as well as fluid abilities, such as making 'far transfer' and using analogy thinking. Tasks can be created for all areas of study (Munro, 2011). Students can respond in a range of formats – for example, written, spoken, drawn or demonstrated. These are scored in ways that assess the complexity of students' knowledge; their thinking and learning capacity; their metacognitive ability; and their ability to interpret and frame up problems and challenges. Procedures for designing, implementing, scoring and interpreting CPS to identify gifted and talented learners are described in Munro (2011).

Composing a creative narrative

This gives students the opportunity to show creativity, complex thinking and far transfer by composing a creative narrative. Composing allows students either to write conventionally, to write in multimodal format or to prepare an oral presentation. An example is composing a creative story about a picture that shows a mug broken into three parts.

This context gives the students the opportunity to think creatively, make far transfer and talk about possibilities. VanTassel-Baska, (2002) recommends five criteria for assessing gifted students' written texts in the language arts: their organisational features; conceptual soundness and quality of ideas; logical argument; use of relevant sources; and form.

Munro (2011) recommends evaluating a composition in terms of the extent to which it shows characteristics of gifted knowing and thinking, which include

1. its purpose – the extent to which the text is focused and achieves its purpose (even though the writer may interpret and 'extend' it in plausible ways), shows a strong commitment to the focus, and links emotion or mood and logic;
2. its ideas – the extent to which the text has relevant but lateral ideas and links them in creative, unusual unexpected ways; and how the text analyses the topic in terms of main ideas that are unexpected and may suggest multiple options. It develops the key ideas in an unusual, insightful way, and suggests possibilities or questions for the topic, as well as unresolved ideas.
3. its use of the conventions of writing – the extent to which the text uses multiple forms to convey the ideas (for example, analogy, imagery, humour or metaphors), has two or more 'subplots' and conveys the set of ideas in a logical, connected way.

gifted learning and thinking behaviours often are not reflected specifically in numerical test scores.

Matching criteria can be used to assess the quality of the paragraph ideas, the sentence ideas and the vocabulary. Composing can be used for a range of topics and in a variety of genres. Munro (2011) provides rubrics for assessing various types of creative writing to identify evidence of gifted knowing and thinking.

'Third step' procedures

Third step procedures, for analysing and evaluating gifted and talented thinking in greater depth, may be necessary for some students. The evaluation examines each student's knowing and thinking in a 'clinical interview' context – for instance, exploring their speed of information processing, their multiple ways of knowing and their high-level thinking. Examples might include how they make far transfer, use analogy and think creatively. These gifted learning and thinking behaviours often are not reflected specifically in numerical test scores. Their responses and solutions will be scored in terms of the qualities they display of ideational fluency and flexibility.

In the individual administration context, it is possible to observe students' ability to think divergently, concentrate and problem-solve. Currently, aspects such as creativity, musical ability, personal skills and motor skills are not generally assessed using standardised tests, and may be better assessed using the informal methods described in this section. The assessment procedures include 'clinical interview' techniques rather than static assessment procedures. Dynamic assessment is used as part of an identification protocol for identifying gifted culturally and linguistically diverse learners, and 'dual exceptional' students (Lidz and Macrine, 2001). A set of typical protocols developed by Munro (2012) allows students to show their gifted knowledge and thinking in ways that are appropriate to their culture and to their learning profiles.

How well do your identification protocols work?

Teachers and schools need ways of checking how well their identification procedures work. This includes how well the various tasks cover the breadth of giftedness and how well the results can be used.

Schools need to interpret and integrate the outcomes of the types of tasks objectively and transparently. The above tasks have been scored on the quality of the knowing and thinking that students show. Procedures for integrating the outcomes are important when a school uses two or more types for identification and when students display their giftedness in different ways.

Many schools prefer to identify these students by quantifying the outcomes of the tasks. A useful procedure, for combining and

interpreting students' scores on two or more tasks, is to prepare a data set that lists each student's raw score on each task and then to convert these to a standard z-score. The z-scores can be used to calculate a score that indicates an overall estimate of each student's gifted knowing and thinking.

This is useful when the tasks have been completed by one or more 'typical grades' of students, some of whom may be gifted. Once the individual scores have been converted to z-scores, the students can be ordered using the set of z-scores for each task. Some schools may prefer to calculate the overall estimate by summing or averaging the z-scores for each student. Some may prefer to use standard deviations to select the gifted and talented students.

Schools also need to know that their identification tasks actually identify gifted knowing and thinking. To do this, you can check the extent to which performance on the various tasks is correlated. The following is an example. A cohort of 11–12 year olds, applying for involvement in a gifted education program, completed the Ravens Progressive Matrices, the problem solving task, the creative writing task, a personal writing task and an interview. Their scores were converted to z scores and a 'composite gifted and talented knowing' score was calculated. The correlation between the tasks (Pearson correlation, 2-tailed, N = 76) is shown in Table 2.

These examples of data show that all of the tasks contribute to the overall estimate of gifted knowing and thinking. The strong correlation between problem solving and Ravens suggests that these tasks are measuring fluid reasoning and, in particular, inferring and analogising. Similarly, the strong correlation between creative and personal writing suggest both are measuring crystallised reasoning. The weaker correlation that the two writing tasks and the interview have with problem solving and Ravens suggests the types of tasks are assessing different aspects of giftedness.

This type of evaluation helps schools examine how reliably and validly their identification processes are working.

Table 2. The correlations between various tasks

	Interview	Problem Solving	Creative Writing	Personal writing	composite score
Ravens	.12	.61**	.19	.17	.61**
Interview		.27	.39*	.43**	.64**
Problem Solving			.38*	.34*	.76**
Creative Writing				.54**	.73**
Personal writing					.72**

** probability p < .01
* probability p < .05

Section Three

Teaching provision for high-ability learners in regular classrooms

Gifted students learn better when the curriculum takes account of what they know. This usually means either modifying the regular curriculum or allowing students to enter it at a level commensurate with their knowledge and skill.

Students are gifted in multiple ways. The most appropriate curriculum for any student takes account of her/his learning profile and the ways in which s/he is gifted. Some students learn the regular curriculum at a much faster rate (Renzulli's 'school-house gifted' or Sternberg's 'analytic gifted'). Others broaden what the regular curriculum teaches (Renzulli's 'intellectual gifted' and Sternberg's 'creative gifted').

One approach to curriculum differentiation is acceleration. In this approach the regular curriculum is not modified. Instead, gifted and talented students may enter it at a higher level or/and progress through it more rapidly. The report *A Nation Deceived: How Schools Hold Back America's Brightest Students Volumes I and 2* (Colangelo, Assouline and Gross, 2004) describes a range of ways in which this can be done (Munro, 2012).

Gifted students learn better when the curriculum takes account of what they know.

The focus in this paper is on a second approach; modifying the curriculum as an approach to curriculum differentiation. Some gifted students are better accommodated by a curriculum that allows them to learn and think creatively and innovatively about topics in the regular curriculum, and to have their self-generated learning outcomes recognised and valued. They learn in regular classrooms with same-age peers and have opportunities for self-extension and enrichment of their knowledge, understanding and ability. On some occasions their thinking will lead to understanding that is taught at higher grade levels. On other occasions, their understanding will be outside of the regular curriculum for higher levels.

Teachers who differentiate in this way usually use the Maker (1986) approach to modify one or more of

- what the students learn (the content);
- how they will learn it (the process);
- how they will show what they have learned (the product); and
- the learning environment and conditions (Tomlinson and Strickland, 2005).

Although successful in accommodating gifted students, this approach is not widely used (Reis et al, 2004). It requires teachers and schools to have a higher level of professional knowledge about curriculum differentiation than acceleration. It also requires greater teacher activity. Teachers need to identify what these students know, the content, how to group or organise them for learning, and appropriate assessment procedures to be used (Anderson, 2007; Rock, et al, 2008; Tomlinson, 2000).

This paper offers an approach to differentiating teaching that is based on the model of how these students learn and think. It can be combined with some of the acceleration provisions – for example, curriculum compacting, mentoring and extracurricular programs.

Section Four

Differentiating from a student knowing perspective

In my earlier paper for CSE (Munro, 2013), I noted that gifted learners spontaneously form understanding or interpretations of a topic that are more complex those of their average-achieving peers, often with a high intuitive loading. To differentiate effectively, teachers need to recognise and interpret their higher-level understanding and to implement teaching that guides these students to analyse and evaluate their intuitive theories. This activity allows the students to form the more elaborated and differentiated knowledge.

The earlier paper (Munro, 2013) described gifted understanding in terms of the understanding formed by regular students. Two broad, higher-level interpretations were proposed and were referred to as 'inferred pattern' and 'big idea' understanding.

When teachers can recognise instances of these levels of understanding in topics they are teaching, they can anticipate the types of understanding that their gifted students can form. This allows them to respond more readily in formative ways to the emerging understanding of these students. They can also design tasks to identify which students are more likely to achieve each level of understanding. This is the approach to differentiation developed in this paper.

An overview of the recommended approach to differentiation

Seven steps are involved in differentiating from a knowledge perspective (Munro, 2010). These are described in depth in the following part of the paper. In summary, for any topic, a teacher

1. identifies the knowledge/understanding of regular students in the National Curriculum;
2. infers and describes the advanced interpretations that gifted students might form at the pattern and big idea levels. These become the outcomes for the gifted students.
3. plans a sequence of learning activities/teaching procedures that guide learning to the outcome at each level;
4. identifies the knowledge prerequisites for forming a patterned or big picture understanding and uses these to design pre-testing activities. This depends on the topic and domain.
5. plans the diffuse problems for the topic to be solved by these students. These help them to apply, use and contextualise their advanced knowledge/understanding.
6. plans how students will share their advanced understanding with the peer group;
7. assesses each student's learning outcomes and reports them in terms of their location on the relevant curriculum learning pathway.

These steps are illustrated for content from the Australian Curriculum in the following areas.

1. Mathematics Year 4 – Apply place value to partition, rearrange and regroup numbers to at least tens of thousands, to assist calculations and solve problems.
2. English Year 6 – Understand how authors often innovate in terms of text structures and play with language features to achieve particular aesthetic, humorous and persuasive purposes and effects.
3. History Year 5 – Historical Knowledge and Understanding. The Australian Colonies: The nature of convict or colonial presence, including the factors that influenced patterns of development, aspects of the daily life of the inhabitants (including Aboriginal Peoples and Torres Strait Islander Peoples) and how the environment changed.
4. History Year 7 – Historical Knowledge and Understanding: The Mediterranean world.

Inferring the advanced interpretations that gifted students might form

Early in the differentiation activity, the teacher forms an impression of what gifted understanding of a topic might 'look like'. You begin with the understanding you expect regular students to form, and frame up more cognitively complex versions of it at the inferred pattern or formulaic level, and the 'big idea' level, by taking account of how the gifted students think in the subject or domain.

Types of inference questions that you can use to interrogate regular understanding are shown in Table 3. It uses the questions and inference to differentiate the AusVELS Grade 5 topic in English, noted earlier, and identifies three phases of understanding, from novice, to patterned, to big idea understanding.

Once you are aware of the characteristics of the interpretations that your gifted students can form, you can begin to plan how you will differentiate your teaching, and how you will identify high-ability entry knowledge and learning. You can use the framework to identify more complex interpretations of any topic from the Australian Curriculum. It also 'tunes you in' to what types of comprehension and enquiries to expect from these students. You are better prepared to interact with their emerging understanding of the topic, and it helps you to engage more effectively in formative assessment with them.

Plan a sequence of learning activities/teaching procedures

You also need to plan a sequence of learning activities/teaching procedures that will help guide learning to the outcome at each level. These can include

- framing up the guiding questions and challenges that students will use to analyse the intuitive aspects of their theories;
- selecting the range of relevant teaching information sources/mentor opportunities to inform learning, personal study and/or research activities, for each 'level' and 'type'; and
- deciding the students' intermediate knowledge outcomes and how you will monitor their progress.

The challenges and stimulus information could be planned collaboratively with experts and the outcomes of this planning mapped into the learning activities that are designed.

You can use popular models for curriculum differentiation (such as those developed by Maker, 1982; Tomlinson, 2000; Renzulli et al, 1976; Braggett et al, 1999; or Kaplan, 1993) to assist with this. You also need to take account of each gifted student's learning profile, the aspects in which s/he is gifted and how well s/he can manage and direct her/his learning and level of motivation for self-directed learning.

Planning the probe questions for each level of complexity about a particular topic

You can use the questions in Table 3 to generate question sequences that will help guide gifted students to develop a more in-depth understanding of any topic. Table 4 shows how they were used to generate questions that foster inference about the History Year 7 topic relating to ancient Egypt.

Table 3. Types of inference questions to generate higher levels of understanding

	Depth of investigation	Level of inference	Application to Grade 5 English topic
Literal understanding	**Regular students**	■ Internalise the teaching. ■ Understand the topic literally in ways that match the organisation in the teaching. ■ Recall specific details in particular contexts.	Identify how writers use language and text structure in particular narratives to achieve humorous purposes and goals.
Pattern understanding	**Identify patterns in the ideas**	■ *What are patterns that could contain the ideas?* Imagine the new ideas as part of a pattern and infer it across contexts. ■ *What are more general ideas that include the ideas you are teaching?* Summarise to form a more general topic.	Compare the multiple types of humour used in narratives – for example, 'laugh at life', 'slapstick', sarcasm', 'self deprecating' – the reasons why authors use them, and how different types of language and text structure form them.
	Identify/infer possible trends	■ Link two or more patterns into a possible causal trend. *How/why did the trend affect/change the direction of the pattern?* ■ Use analogies to make far transfer links. ■ analyse the new ideas from multiple perspectives using 'higher-order' thinking strategies and synthesise the outcomes.	
	Generate possibilities	■ Question the patterns, generate possibilities and options. *How did the patterns affect/contribute to …? What might happen if …?*	How/why do the ages of characters and their power relationships with others in a written text affect the type of humour that works?
Big picture understanding	**Identify generalities, rules**	■ Ask 'what are the general ideas or rules that cover the topic?' ■ Re-organise and re-prioritise aspects of their knowledge so that they can think in terms of main and subordinate ideas at once, for example, *Make X the main idea instead of Y. How does the interpretation change?*	Compare how different genres of writing (for example, narrative, poem, jingle, an advertisement) use different types of language to achieve different types of humour, the reasons why authors use them and how different types of language and text structure form them.
	Infer ethical issues	■ Link moral/ethical issues with the rules or general propositions: *What/how/why should/might …?*	
	Identify/infer and link big ideas	■ Build principles in the set of topics. ■ Infer how the 'big ideas' could be used to solve problems and make decisions, see possible moves and options. *If this happens, then … but because of … I would….* ■ And infer the ideas could be used to generate creative knowledge.	

Table 4. Questions that foster inference about ancient Egypt

		Communicating in writing	Technology
Challenge for learning – apparent paradoxes in the culture		■ *How do hieroglyphics differ from contemporary written languages as a system for communicating?* ■ *What types of ideas are/are not easily communicated using hieroglyphics?* ■ *What can we learn about the people who developed/used the system?*	■ The ancient Egyptian culture produced outstanding technology products that exist today. Their culture did not have our technological means or education. *How did they produce these outcomes?*
Novice learner	**Literal understanding of the topic**	■ Describe and explain Narmer's Palette and the Rosetta stone. ■ Describe the characters of Egyptian writing. ■ Explain the origin of each.	■ *What raw materials were used?* ■ *What industrial processes, sources of energy and technological procedures were used?*
Pattern learner	**Identify a pattern across details**	■ *What patterns are in the symbols on Narmer's Palette and the Rosetta stone?* ■ *What was the purpose of each for communication?* ■ *How is Narmer's Palette like a poster?*	■ Identify the patterns in building. ■ Identify the pattern shown in used water for irrigation.
	Trend – factors that influence pattern	■ *What might have caused the written Egyptian communication forms to develop in this way?*	■ *What trends do you see in the use of technology in ancient Egypt?*
Big picture understanding	**Question the trends and factors**	■ *Were the sacred carvings/hieroglyphics part of a trend or did they set one?*	■ *What do the trends suggest about how technology developed?* ■ *Did these things apply in the settlement away from water?*
	Rules – formulate the trend as a rule	■ *Did rules apply to hieroglyphics or were they set as a result of the development and use of an artistic code of writing?*	■ *What does ancient Egypt tell us about the rules for developing technologies?*
	Ethical issues	■ *In what ways were written messages used for the public good and to foster human freedom vs subjugation and restrictions.* ■ *How can a culture respect humanity through its writing?*	■ *How can the wonderful technological products justify the inhumanity to thousands of workers?* ■ *Can the money spent on archaeology be justified when money is needed for other services?*
	Understanding big ideas	■ *How did the development of writing systems help cultures to develop, for example, its technology and industrial base?*	■ *How are the developments in technology in ancient Egypt transferable to other cultures?* Consider modern architecture, irrigation, energy use.
	Principles in a body of knowledge	■ *How was an ancient culture represented in its language?*	■ *How was the development of technology in ancient cultures constrained by access to energy?*

Developing a topic across multiple contexts

Sometimes a topic is developed across multiple contexts. Examples are

1. learning about more than one ancient culture; and
2. learning how different texts, language and text structure generate humour.

In these cases, it is useful to give the gifted students increasing self control for their learning. To do this, guide their higher-level thinking in the first context and gradually remove the scaffolding in the second and third contexts. In addition, guide them to synthesise what they learn into a 'big picture' for the topic, as they progress through the contexts. See Table 5 for an example.

A similar teaching approach can be used to differentiate the English Sub Strand objective *Interpreting, analysing, evaluating; Focus of thread; Analysing and evaluating texts*, at Year 8: Explore and explain the ways in which authors combine different modes and media in creating texts, and the impact of these choices on the viewer/listener (see Table 6).

Anticipate gifted learning and thinking

It is useful to anticipate what each aspect of gifted learning and thinking would 'look like' in your classroom practice. For topics that you are teaching, anticipate instances of student knowledge generated by each characteristic of learning and identify how you could modify your teaching provision to accommodate it.

Table 5. Example for a history topic examining how ancient cultures developed communication systems

<table>
<tr><th></th><th>Egypt</th><th>Rome</th><th>Japan or China</th></tr>
<tr><td>Literal understanding of details.</td><td rowspan="6">Provide a learning pathway that guides the students' thinking.</td><td rowspan="6">Using a guiding question pathway, students draw out similarities/ differences and infer their causes. They predict for other cultures.</td><td rowspan="6">Students plan and design their own study.</td></tr>
<tr><td>Infer patterns in the ideas.</td></tr>
<tr><td>Identify/infer possible trends between two or more patterns.</td></tr>
<tr><td>Generate possibilities, unknown ideas and patterns from what is known.</td></tr>
<tr><td>Identify the generalities and rules about the set of ideas.</td></tr>
<tr><td>Identify/infer ethical issues associated with the set of ideas.</td></tr>
<tr><td>Identify/infer big ideas by examining the rules across cultures, times and contexts.
Predict into the future.</td><td colspan="3">■ Do rules seem to underpin the development of communication in ancient cultures?
■ What knowledge of communication existed across the three cultures? How did they differ?
■ In what ways was communication used for the public good?
■ To what extent did communication foster human growth vs subjugation/freedom vs restrictions?</td></tr>
<tr><td>Link the big ideas within a broader body of knowledge.</td><td colspan="3"></td></tr>
</table>

Table 6. Example of differentiating a sub-strand objective

<table>
<tr><th></th><th>Text 1</th><th>Text 2</th><th>Text 3</th></tr>
<tr><td>Literal understanding of details.</td><td rowspan="6">Guide students to analyse and evaluate how the author uses modes and media to create the text.</td><td colspan="2" rowspan="6">Students plan and direct their analysis and evaluation of how the author uses modes and media to create the text.
They take increasing control of their learning.</td></tr>
<tr><td>Infer patterns in the ideas.</td></tr>
<tr><td>Identify/infer possible trends between two or more patterns.</td></tr>
<tr><td>Generate possibilities, unknown ideas and patterns from what is known.</td></tr>
<tr><td>Identify the generalities and rules about the set of ideas.</td></tr>
<tr><td>Identify/infer ethical issues associated with the set of ideas.</td></tr>
<tr><td>Identify/infer big ideas by examining the rules across texts and predict about future texts.</td><td colspan="3">■ Identify the regularities used by authors in their use of modes and media in creating texts, and the impact of these choices on the viewer/listener
■ Infer how these regularities are affected by genre and the purpose of the author.</td></tr>
<tr><td>Link the big ideas within a broader body of knowledge.</td><td colspan="3"></td></tr>
</table>

Plan formative assessment procedures

Plan and clarify your role as a learning coach for gifted students in the domain. This includes identifying how you will scaffold and guide their learning activity. Plan the learning pathways they will follow and develop formative assessment procedures for monitoring their learning progress.

Pre-testing to identify gifted and talented learners and to determine their comprehension of a topic

Many approaches to gifted education provision use the concept of advanced or superior learning capacity, or 'outstanding natural abilities or aptitudes' (Gagné, 2010, p 82), to refer to giftedness and to distinguish it from what is learned (the talents or competencies). A key aspect of differentiation involves identifying in students this capacity for topics that you will teach. When you have identified what the gifted understanding might 'look like', you need to decide how you will identify students' existing knowledge of the topic.

You need to decide the indicators of learning/thinking at the patterned and big ideas levels of advanced understanding, and use these to design pre-testing activities. This depends on the topic and domain. You want to know, for example, whether the student has already speculated about possible links between the topic ideas and others, and whether they have unanswered questions about possibilities.

Various types of tasks can be used to allow students to show what they know about a topic. You can ask students, for example, to

- draw a concept map of what they know about the topic and/or what they think they will know having learned it. You can ask them to show how the ideas are linked and to mention possible ideas and their intuitions.
- write a brief response that indicates what they know about the topic, and which mentions unanswered questions they have about it;
- select, from a list of concepts or pictures about the topic, what they would expect to the key concepts or ideas, and to organise these into big ideas, main ideas and details, or to show how key aspects are linked, using Venn diagrams or flow charts;

Table 7. A grid to help explore how gifted and learning and thinking might look in the classroom

Characteristic of topic learning: the gifted student The student …	What would this look like in a classroom?	How could I modify my teaching provision to accommodate these ways of thinking?
takes the ideas apart rather than interprets or applies		
links ideas in lateral, broad unexpected ways		
keeps track of several ideas at one, and can think in several directions		
Thinks in larger jumps, skipping steps in the thinking		
sees novel connections between ideas quickly; infers		
solves problems in unusual or novel ways		
asks spontaneously complex questions about ideas		
uses imagination or fantasy; shows 'intellectual playfulness'		
shows focused, intense interest in a topic		
is self-motivated to think and learn about the topic.		
As the teacher		
As the teacher ■ monitor and direct their learning; ■ plan how they will learn; ■ monitor their learning; and ■ review progress.		

- match word and/or pictures; label a diagram about the topic;
- draw a picture or diagram of the ideas they have about the topic; make a model;
- complete short-answer and multiple-choice tasks, or cloze tasks;
- recognise or select plausible and implausible ideas about the topic; or
- suggest questions that they think they might be able to answer having learned the topic.

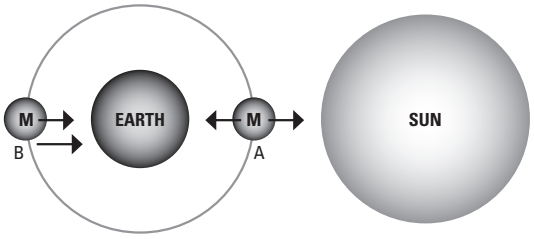
You can analyse the responses from a group of students to identify those who show greater conceptual complexity and differentiation of the ideas. You can select those responses that suggest a capacity to learn the topic at the pattern and big idea levels.

In designing pre-testing tasks, keep in mind that students' gifted knowledge can be in multiple forms (verbal, imagery and action-based, etc). The tasks you use to identify their knowledge need to take this into account.

Where possible use tasks that give students the opportunity to tell 'all they know' about a topic and then probe this in greater depth. Ensure that students are familiar with the task frame and know how to use it to show what they know.

These tasks show gifted students' rich meaning networks and their intuitive theories. Recently, I wanted to know what a Grade 4 class knew before beginning a unit on the Solar System. I asked the students to reflect on this and to note what they knew. When I pooled what the

students knew, one student, Tom, said 'The Moon is moving closer to the Earth'. He drew the following diagram (obviously shown as a more 'finished' version here) to unpack his theory.



He explained that when the Moon was at point A, between the Earth and the Sun, it is pulled in opposite directions and moves away from the Earth. When it is on the opposite side at B, both forces are pulling it towards the Earth. Another student linked this with going up and down on a trampoline.

Tom had an understanding about the topic that exceeded that of his peers. In the subsequent learning activities, he had the opportunity to unpack and explore his theory. Without the pre-teaching activities, I would not have been aware of his existing understanding and thinking.

Wisdom is the ability to use one's understanding for the common good and to link it with values and dispositions.

Learning using contextual/social problem solving

In addition to forming more complex interpretations of a topic, the gifted students can learn more about the topic by applying and transferring the new understanding. One way of doing this is to engage them in the contextual/social problem solving used for the second identification phase

Sternberg's WICS model (Wisdom, Intelligence, Creativity, Synthesised) (2005) proposes that giftedness comprises the synthesis of aspects of knowledge: Intelligence is the ability to interact with one's environment by the balancing of analytical, creative, and practical aspects of understanding; Wisdom is the ability to use one's understanding for the common good and to link it with values and dispositions.

Contextual/social problem solving is used here as a learning opportunity for the gifted students. It allows them to apply the aspects of WICS to extend their understanding. They apply their analytical, intellectual skills to the issue, their practical intellectual skills to contextualise and evaluate, their creative skills to generate novel possibilities, and their wisdom-related skills and attitudes to assess the long-term and short-term impacts of the ideas on the group.

You and/or your students can generate a social problem that contextualises any topic you are teaching in the 'real world'.

For the Year 6 English topic noted earlier, examples of problems include the following.

- ***At the Pattern understanding level ask the following questions.***

  How do narratives use language in different ways to be funny?

  What are different ways in which stories can be funny?

- ***At the Big Ideas understanding level, compare the different ways in which different genres say things that are funny.***

  What is the best genre for using sarcasm, 'dry humour' or 'witty humour'.

  What types of funny stories do younger and older children enjoy?

  How does children's enjoyment of the different types of humour change as they get older?

The problems need to be relevant and comprehensible to young participants. You can design problems and implement this teaching activity, as described in the earlier section on contextual/social problem solving.

Students can solve problems both individually and collaboratively. Where students from different classes and schools are studying a topic at the same time, the gifted students could use the internet to work together on a problem and build a shared knowledge. These online

networks form 'virtual learning communities'. Such 'like-minded' collaborative learning opportunities are important for gifted students.

Using the gifted understanding of a topic to build group knowledge

When the gifted students have collated their new understandings, they can share them with peers and the broader community. This is a component of Sternberg's wisdom aspect. Gifted students frequently need to learn the skills associated with communicating the understanding with non-gifted peers. This includes learning how to organise their understanding in a form that makes it easy for them to share with peers. They can select one or more of the examples of formats shown in Table 8 and combine them into a multimodal composition to do this.

Table 8. Examples of formats to organise understanding

Concrete models	Model, invention, diorama, sculpture, simulation, puzzle, exhibit
Oral formats	Debate, story, teaching lesson, poem, survey, questionnaire, value statement
Dramatic formats	Puppet show, pantomime, play book, demonstration, new game
Pictorial formats	Cartoon, diagram, television show, map, illustration, photographs, chart, filmstrip, graphic representation
Written prose formats	Editorial, opinion, news article, advertisement, written report, recipe, magazine, computer program, recommendation, scrapbook, letter, report, journal, bulletin board

Section Five

Where to in the future for gifted education?

Recent evaluations of gifted education provision have noted the ineffectiveness of both identification protocols and teaching approaches (Subotnik et al, 2011; Ziegler, Stoeger and Vialle, 2012). Ziegler, et al (2012) call for a paradigm change in how we conceptualise giftedness and, consequently, our provision for it. They recommend that this conceptualisation be founded on eminence and learning pathway – ie, where gifted individuals pursue an identifiable learning pathway that leads to eminence. Eminence by its nature is comparative.

The approach developed in this paper and its companion piece, referred to earlier (Munro, 2013), examines gifted knowing and thinking in the classroom. The first paper described a learning pathway that explained how these students form qualitatively different understanding of topics; the personal intuitive theories that lead to enhanced meaning networks. This understanding can lead to 'eminent' outcomes. These are less likely from understanding that is typical, regular and expected for a cohort. This second paper describes an approach to identification and teaching that recognises and fosters these more sophisticated learning outcomes.

In the two papers I have attempted to target a continuing issue in gifted education provision: the capacity of teachers and schools to identify, reliably, instances of gifted understanding and to implement effective teaching. The approach, when combined with contemporary electronic technology, can enhance future provision, as suggested in the following three points.

1. Topics in the Australian Curriculum can be linked with higher levels of understanding

that match patterned and big-idea inferential thinking, and that can facilitate planning, management and monitoring of the learning pathways of these students.

2. National and state assessment regimes can include items that assess these levels of comprehension and assist in identifying these students.
3. School intranets can include recommended pre-testing protocols and teaching procedures, as well as support materials and information that teachers can use to develop learning pathways for these students.

A school's capacity to implement effective provision for gifted learners is determined by teachers' professional knowledge. Teachers can differentiate their teaching more effectively when they

- understand how these students learn and think;
- know a range of teaching options for differentiating their teaching, and know what these look like;
- apply the differentiation procedures to topics in their classroom;
- are motivated to differentiate for giftedness and talent; and
- can 'read' the culture and climate in their school and classroom in terms of this differentiation – how to link with particular contexts and particular gifted profiles.

A possible professional learning schedule for a school intending to improve its provision is shown in Table 9.

Australia needs to build a strong national knowledge base. The mining boom is running its course. We know from PISA data that our educational provision is not strong at extending the learning outcomes of the higher achieving students. We can mine iron ore. This paper and its preceding companion piece are intended to show that we can develop the minds of our students.

Table 9. A possible professional learning schedule

Week	Teacher and professional learning team activity
1–3	Select topics from the Australian Curriculum, identify the knowledge/understanding of regular students and infer advanced level knowledge/understanding or interpretations that high-ability students might be expected to construct, using the novice–patterned–expert or 'big picture' sequence.
1–3	Identify what these types of understanding would look like in regular classroom activities.
4–	Plan a sequence of learning activities/teaching procedures, needed to guide learning at each level, which will guide student learning to the outcome.
6–	Identify the indicators of being able to learn/think at each level of understanding and use these to design pre-testing activities.
7–	Plan the diffuse problems that will assist students to apply, use and contextualise their advanced knowledge/understanding in individual and small-group collaborative problem solving.
8–	Plan how students will share their advanced understanding with the peer group.
9–	Decide how each teacher will report each student's learning outcomes in terms of that child's location on the relevant curriculum learning pathway.

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About the Author

Dr John Munro is Head of Studies in Exceptional Learning and Gifted, in the Graduate School of Education at The University of Melbourne. He is a trained primary and secondary teacher and a psychologist. His research interests, teaching and publications are in the areas of literacy and mathematics learning and learning difficulties, learning internationally, gifted learning and learning disabilities, gifted mathematics learning, implementing system-wide gifted education provision, instructional leadership and school improvement.

About the Paper

This paper is a companion piece to Dr Munro's previous paper for CSE, *Gifted students as expert+ knowers: A teaching friendly model of gifted knowing and understanding?* (CSE Seminar Series Paper 225, published in July 2013). Here Dr Munro offers a framework for teaching gifted and talented students in the 'regular' classroom. He discusses how to identify gifted and talented knowing and thinking, and offers a multi-phase systematic identification protocol; comments on how to provide appropriate teaching in a 'mainstream' context; and explores ways to help students form more elaborated and differentiated knowledge. He concludes that building the capacity of teachers and schools to identify gifted understanding reliably, and to implement effective teaching based on that evidence – particularly when combined with high-quality use of information and communication technologies – provides a solid base to enhance the future education of gifted and talented students, with benefits for all who study in the same classroom.

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