Empowering Excellence: Leading the Way for Gifted Students

Session 3: What practices are used to identify excellent outcomes for the multiple types of gifted learning profiles?

John Munro

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To empower excellence in a school, empowerment at the classroom level is necessary

Educational provision does the empowering, through differentiated curriculum, teaching and classroom culture and climate.

Pathway for this session

Framework for differentiating the teaching

Planning more advanced levels of knowledge

How to differentiate Phase 3 teaching

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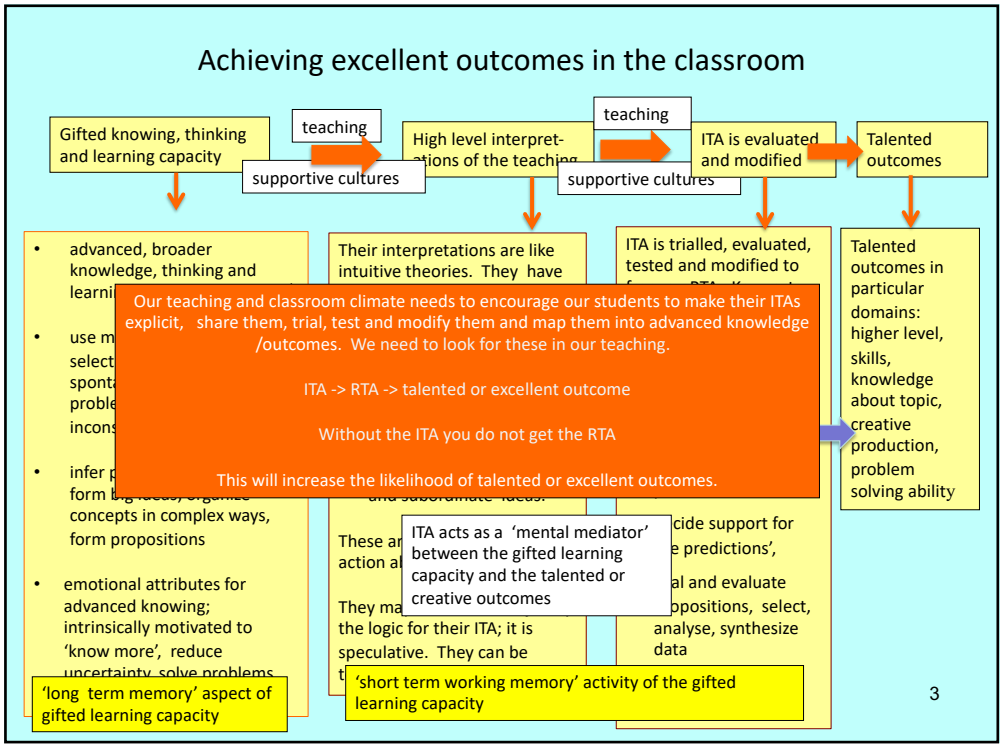
Achieving excellent outcomes in the classroom
Gifted knowing, thinking and learning capacity
teaching
supportive cultures
High level interpret-ations of the teaching
teaching
supportive cultures
ITA is evaluated and modified
Talented outcomes
advanced, broader knowledge, thinking and
use m
select
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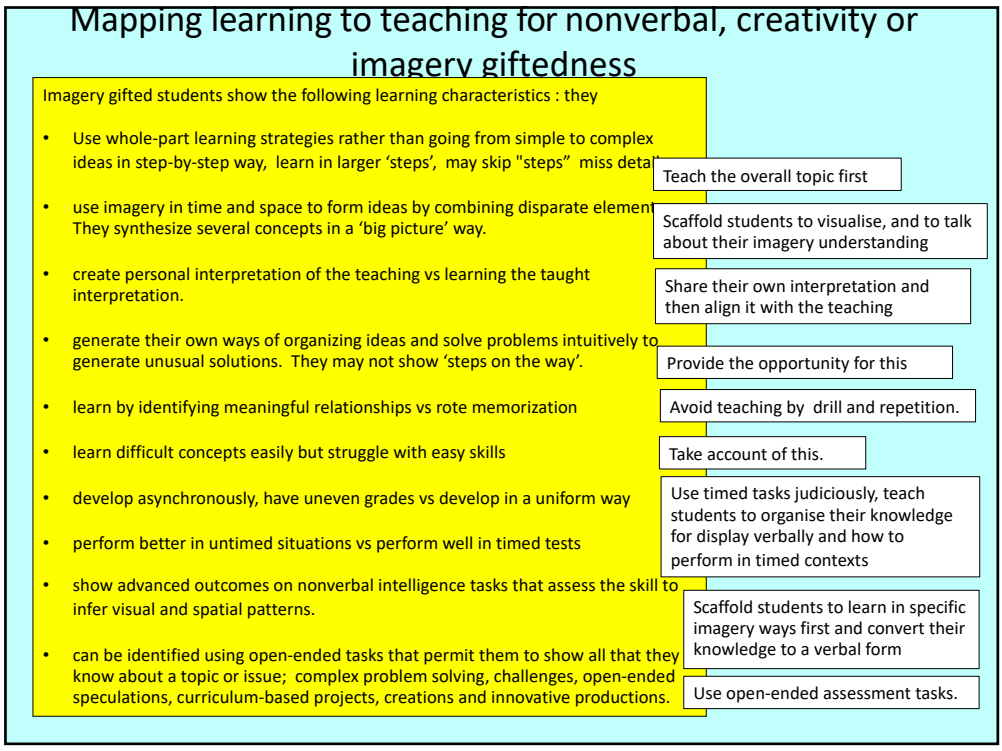
concepts in complex ways, form propositions
emotional attributes for advanced knowing; intrinsically motivated to 'know more', reduce
'long term memory' aspect of gifted learning capacity
Their interpretations are like intuitive theories. They have
These ar
action al
They ma
the logic for their ITA; it is speculative. They can be
'short term working memory' activity of the gifted learning capacity
ITA is trialled, evaluated, tested and modified to
cide support for
e predictions',
al and evaluate
positions, select, analyse, synthesize data
Talented outcomes in particular domains: higher level, skills, knowledge about topic, creative production, problem solving ability
Our teaching and classroom climate needs to encourage our students to make their ITAs explicit, share them, trial, test and modify them and map them into advanced knowledge /outcomes. We need to look for these in our teaching.
ITA -> RTA -> talented or excellent outcome
Without the ITA you do not get the RTA
This will increase the likelihood of talented or excellent outcomes.
ITA acts as a 'mental mediator' between the gifted learning capacity and the talented or creative outcomes
3

3


Mapping learning to teaching for nonverbal, creativity or imagery giftedness
Imagery gifted students show the following learning characteristics : they
Use whole-part learning strategies rather than going from simple to complex ideas in step-by-step way, learn in larger 'steps', may skip "steps" miss deta
Teach the overall topic first
use imagery in time and space to form ideas by combining disparate element They synthesize several concepts in a 'big picture' way.
Scaffold students to visualise, and to talk about their imagery understanding
create personal interpretation of the teaching vs learning the taught interpretation.
Share their own interpretation and then align it with the teaching
generate their own ways of organizing ideas and solve problems intuitively to generate unusual solutions. They may not show 'steps on the way'.
Provide the opportunity for this
learn by identifying meaningful relationships vs rote memorization
Avoid teaching by drill and repetition.
learn difficult concepts easily but struggle with easy skills
Take account of this.
develop asynchronously, have uneven grades vs develop in a uniform way
perform better in untimed situations vs perform well in timed tests
Use timed tasks judiciously, teach students to organise their knowledge for display verbally and how to perform in timed contexts
show advanced outcomes on nonverbal intelligence tasks that assess the skill to infer visual and spatial patterns.
Scaffold students to learn in specific imagery ways first and convert their knowledge to a verbal form
can be identified using open-ended tasks that permit them to show all that they know about a topic or issue; complex problem solving, challenges, open-ended speculations, curriculum-based projects, creations and innovative productions.
Use open-ended assessment tasks.

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Mapping learning to teaching for convergent or verbal gifted

In the classroom verbally gifted students learn faster. They

- Learn faster than their peers. in a given time they can fo
  and are ready to explore it sooner than peers. They don't
  programmed in a 'bit by bit' way.
- They use their more elaborated and differentiated concep
  in larger chunks and deal with more information at a time
- Organize and fit together the ideas in their own ways and check their interpretations against the information. Their initial int
  to be intuitive.
- use high level text- type thinking. They infer spontaneously the topic, details, section meanings and the intended purposes. This allow
  ahead'. They make link with other texts, add ideas not
  text. They form more elaborated and extensive interpre
- analyse spontaneously aspects of a text at a high level, e
  themes in two or more texts, compare texts within and
  common elements, interpret characterization in imagina
  within- and between text links.
- want to be self-programming and to manage their own l
  rapidly the rules and conventions for a text. They use th
  ideas in the intended ways.

Compact the curriculum, provide higher level materials when mastery is shown, allow students to learn at their own rate and to pursue self-selected topics with guidance.

Teach broader, interconnected themes vs isolated topics, use mind maps to connect ideas, provide complex problem-solving tasks.

Ask students to explain and justify their interpretations them, learn how to organize and present their understanding..

Use high-quality texts from various genres with advanced vocabulary and concepts, provide multiple texts for students to compare, contrast, and synthesize.

Teach text analytical techniques explicitly (theme analysis, character analysis), comparison across genres, themes, or authors..

Teach students how to set, monitor, and achieve their learning goals and use timelines. Offer a range of tasks from which students can choose based on interest.

5

Mapping learning to teaching for procedural or action giftedness.

In the classroom these gifted students show their gifted learning capacity by doing or acting in novel ways to form outcomes that are different, lateral, original or creative productions or ways of solving problems. They are the 'problem-solving innovators'.

They

- Their talent is shown in the quality, complexity and sophistication of the action sequences they perform, particularly in solving real life problems everyday contexts.
- think in actions, learn new action or motor sequences very easily, integrate action sequences to form 'big idea' action sequences
- infer how a set of actions that works in one type of situation can be modified to work in a different type of situation → creative, innovative or talented outcomes
- modify their action sequences to match new or changed contexts,. do component actions in a different sequence or simultaneously, change duration of components.
- Integrate actions used in multiple domains, combine actions from different sequences, make 'fluid analogies' or 'far transfer' between action sequences.
- create novel action sequences, and can see new ways of achieving a go
  or an outcome, skilled at interpreting a situation as a problem and actin

Provide opportunities for students to show their understanding through problem solving in particular contexts

Scaffold students to interpret topics you are teaching from an active action perspective.

Scaffold them to think of the key concepts and relationships as actions.

Identify challenges in topics and invite students to suggest how they might respond to them.

Put themselves into the context, imagine the actions being done. Imagine how the actions might change with changes in particular parts of the context.

Give them time to convert their action thinking to words

Provide opportunities to learn a topic by doing the characteristic actions, interpret verbal information by acting. Used embodied teaching.

Teach new ideas in practical everyday situations.

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Three components of a differentiated teaching and learning program

The teaching and learning program that leads students to the higher-level outcomes comprises two components:

A differentiated teaching component.

The teacher differentiates their regular classroom teaching by including prompts and cues that guide students to think about it at higher level. This scaffolds students with high ability profiles to begin to form more advanced interpretations of the teaching.

A differentiated curriculum component

This teaches the higher-level knowledge outcomes while their peers pursue the regular curriculum. It combines both teacher-directed activity and autonomous student-directed learning. It can be structured as a project that extends the regular content.

A differentiated curriculum component

The culture and climate is flexible and open, accepting and nonjudgmental of how these students know, learn and interact socially. It

- encourages independent and intrinsic learning, complex and abstract thought.
- takes account of students' existing knowledge and skills in a range of ways
- uses flexible grouping to allow work with like-minded peers.
- use learning contracts to allow students to work independently, set goals and develop management skills, use learning centres that have activities that vary in complexity.

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How to differentiate the teaching for excellent understanding

Include cues, questions in the teaching that ask students to think about the ideas in increasingly more complex ways that guide students to form more complex interpretations - their ITAs

Interpret, store teaching information	• identify ideas and links between them in the teaching information. • Think in ways cued or scaffolded explicitly by the teaching.	
Infer patterns in the ideas	• infer specific ideas not included in the topic, identify what they share. • infer patterns or more general ideas that contain the ideas; summarize, imagine key ideas as part of a pattern, decontextualize, extend across contexts and abstract the pattern.	*Look at what these instances or contexts have in common. What is the pattern here?*
Infer possible trends	• link two or more patterns into a possible causal or consequential trends. • analyse the new ideas from multiple perspectives.	*How / why did the trend affect/ change the direction of the pattern?*
Generate possibilities	• c • e links, use analogies, look for possibilities and options	*How did the patterns effect/ contribute to …. ? What might happen if ..? ,*
Infer rules and principles	• infer rules or general propositions, identify their boundaries. • synthesize the inferred patterns into big ideas by forming rules, formulate and understand rules and principles	*Make X the main idea instead of Y. How does the interpretation change? What is the rule here ?*
infer ethical issues	• link moral / ethical issues with the rules or general propositions	*What / how/why should….?*
Infer, synthesize big ideas	• infer how the 'big ideas' could solve problems and generate creative outcom • use 'big ideas' in topic fluently to make decisions, • infer and investigate broader possibilities and options.	*If this happens, then .., but because of .. I would…. What might you do if … Why wouldn't you .. ? What if…"*

Use this framework for differentiating teaching at each phase of learning

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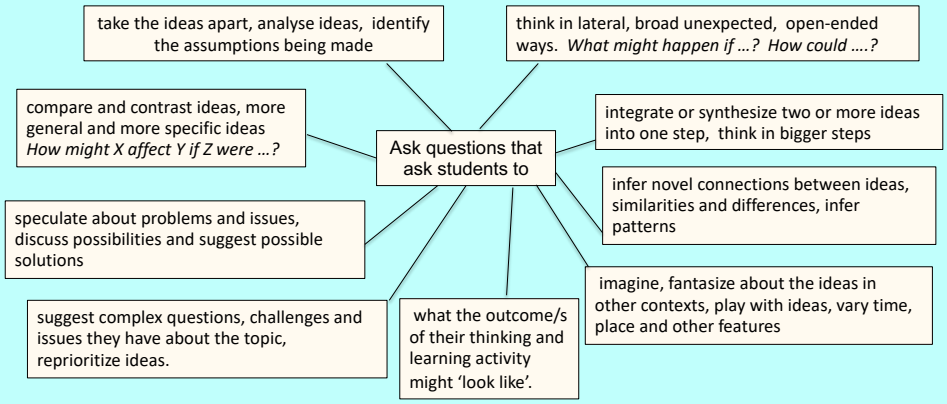
Examples of ways of differentiating teaching to probe higher learning and thinking during teaching



These types of tasks provide the formative assessment data teachers can use to identify instances of gifted learning

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How to differentiate the teaching for excellent understanding

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Interpret, store teaching information	• identify ideas and links between them in the teaching information. • Think in ways cued or scaffolded explicitly by the teaching.	
Infer patterns in the ideas	*How would you act out 'laugh at life', 'slapstick', sarcasm'? How are the actions similar? How are they different?*	*Visualise these different examples of humor. What do they have in common? How does 'laugh at life', 'slapstick', sarcasm' look different?*
Infer possible trends	*What actions do you do to match the language that indicate: 'laugh at life', 'slapstick', sarcasm', 'self deprecating' humor? What action do you link with each type of humor*	*Visualise the type of humor you form when you hear various types of language? What type of language would go with 'laugh at life', 'slapstick', sarcasm', 'self deprecating'?*
Generate possibilities	*What might happen if an author had a character (for example, laugh at themselves or use sarcasm)?*	Imagine how a serious fairy tale story would change if a character suddenly became funny, for example, *the Big Bad Wolf kept forgetting what* ***he was supposed to do?)***
Infer rules and principles	*Act out the humor in a narrative, poem, jingle, and an advertisement. What are common language features that humor has in all the examples?*	*Visualise humor in a narrative, poem, jingle, and an advertisement. What are common language features that make humor in all the examples?*
infer ethical issues	*When is it ethical/moral to act in* 'laugh at life', 'slapstick', sarcastic', 'self deprecating' *ways?* .	*Visualise the effect of different types of humour in text on how people feel. When it can be used ethically/morally*
Infer, synthesize big ideas	How can people's reactions to humour tell us about them and how they see the world?	Imagine different people's reactions to humour in a story. What does it tell us about them and how they see the world?

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How to differentiate the teaching for excellent understanding

A fourth grade class is learning the topic. “What’s inside me "and in particular the structure of their hands and feet.

Interpret, store teaching information	They are answering the question: How do you think the bones in each finger are joined together so that they can move?	
Infer patterns in the ideas	What problems would we have moving our fingers if the joints were straight, not curved?	Why do you think the joints in the finger bones are curved? Imagine if they had straight edges. How would this affect how they move?
Infer possible trends	Watch your fingers and thumb move. What does this tell us about how many joints and bones are in each?	Move your thumb. How does it move differently from the fingers? How can you tell it has two bones?
Generate possibilities	How many bones do you think are in each of your toes? How did you decide this?	Suppose you design a ‘robot’ hand. How would the number of joints in each of its ‘fingers’ affect what it could do?
Infer rules and principles	How could you tell which pawed animals in a zoo might have two or more bones in each digit?	What if the base of the thumb bone was closer to the base for the finger bones? How well could your thumb move? Do you think the bones in your big toes are more like the bones in your thumb or the bones in your fingers?
Infer, synthesize big ideas	Imagine how human hands have changed over history? How might our hands change in the future as we use them differently? How could medical discoveries help us use our hands differently.	How might our hands change in structure if we use them differently? How would our lives be different if we had fewer bones in each hand?

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Synthesize the cues into a teaching sequence

	Grade 5 students reading Chapter 2 of Boy by Roald Dahl	Year 7 students learning about hieroglyphics in ancient Egypt
challenge	This chapter is about Roald’s time in primary school. What do you think might have been the most important things to him during this time?	How do hieroglyphics differ from contemporary written languages? What types of ideas are/ aren’t easily communicated using them? What can we learn about the people who used them?
Infer patterns and relationships	Why do you think Roald Dahl thought the licorice bootlaces were the best value? What does Thwaites’ story about licorice tell you about the boys?	What patterns exist in the use of symbols on Narmer’s Palette and the Rosetta stone? How was each used for communication? How is Narmer’s Palette like a poster?
Infer trends	Why do you think Roald Dahl describes Mrs Pratchett in the way that he does? What feelings do you think the boys had as they passed the sweet shop? What do their actions tell us about how they felt?	What might have caused the written Egyptian communication forms to develop in this way?
Generate possibilities	Roald Dahl says: “To us it was what bar is to a drunk or a church is to a Bishop.” Why do you think he says this? The next sentence begins with But. Why do you think Roald Dahl used *but* in this case?	Were the sacred carvings and hieroglyphics part of a trend or did they set one? Did rules apply to hieroglyphics or were they set as a result of the development and use of an artistic code of writing
Infer ethical, moral issues	How would the boys’ ethics and morals clash with those of Mrs Pratchett ?	In what ways were written messages used for the public good and to foster freedom vs subjugation and restrictions. How can a culture respect humanity through its writing ?
Infer big ideas	What do you think is the purpose of this chapter in Boy? How does it fit with the rest of the text? It provides a context and tells you more about the protagonists	How did the development of writing systems help cultures to develop, for example, its technology and industrial base?

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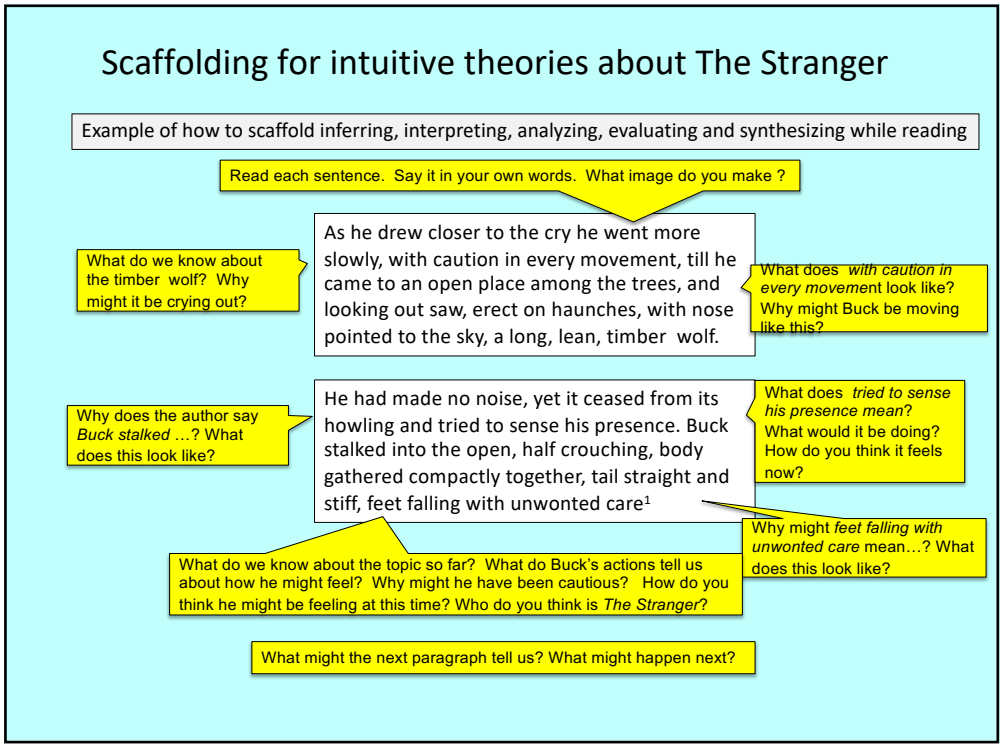
Scaffolding for intuitive theories about The Stranger
Example of how to scaffold inferring, interpreting, analyzing, evaluating and synthesizing while reading
Read each sentence. Say it in your own words. What image do you make ?
As he drew closer to the cry he went more slowly, with caution in every movement, till he came to an open place among the trees, and looking out saw, erect on haunches, with nose pointed to the sky, a long, lean, timber wolf.
What do we know about the timber wolf? Why might it be crying out?
What does with caution in every movement look like? Why might Buck be moving like this?
He had made no noise, yet it ceased from its howling and tried to sense his presence. Buck stalked into the open, half crouching, body gathered compactly together, tail straight and stiff, feet falling with unwonted care[1]
Why does the author say Buck stalked …? What does this look like?
What does tried to sense his presence mean? What would it be doing? How do you think it feels now?
Why might feet falling with unwonted care mean…? What does this look like?
What do we know about the topic so far? What do Buck's actions tell us about how he might feel? Why might he have been cautious? How do you think he might be feeling at this time? Who do you think is The Stranger?
What might the next paragraph tell us? What might happen next?

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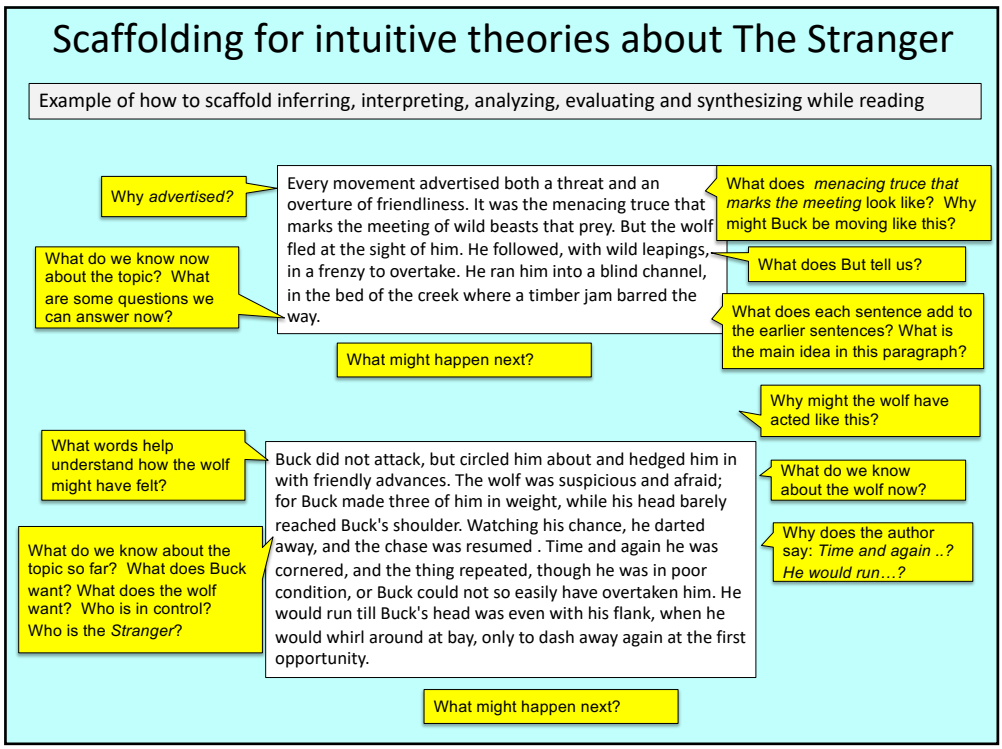
Scaffolding for intuitive theories about The Stranger
Example of how to scaffold inferring, interpreting, analyzing, evaluating and synthesizing while reading
Why advertised?
Every movement advertised both a threat and an overture of friendliness. It was the menacing truce that marks the meeting of wild beasts that prey. But the wolf fled at the sight of him. He followed, with wild leapings, in a frenzy to overtake. He ran him into a blind channel, in the bed of the creek where a timber jam barred the way.
What does menacing truce that marks the meeting look like? Why might Buck be moving like this?
What do we know now about the topic? What are some questions we can answer now?
What does But tell us?
What does each sentence add to the earlier sentences? What is the main idea in this paragraph?
What might happen next?
Why might the wolf have acted like this?
What words help understand how the wolf might have felt?
Buck did not attack, but circled him about and hedged him in with friendly advances. The wolf was suspicious and afraid; for Buck made three of him in weight, while his head barely reached Buck's shoulder. Watching his chance, he darted away, and the chase was resumed . Time and again he was cornered, and the thing repeated, though he was in poor condition, or Buck could not so easily have overtaken him. He would run till Buck's head was even with his flank, when he would whirl around at bay, only to dash away again at the first opportunity.
What do we know about the wolf now?
What do we know about the topic so far? What does Buck want? What does the wolf want? Who is in control? Who is the Stranger?
Why does the author say: Time and again ..? He would run…?
What might happen next?

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The Stranger : How does the mood change?

How do the mood and feeling of the text change? How does Buck's / the wolf's feeling change?

How does the action in the text change?

As he drew closer to the cry he went more slowly, with caution in every movement, till he came to an open place among the trees, and looking out saw, erect on haunches, with nose pointed to the sky, a long, lean, timber wolf.

He had made no noise, yet it ceased from its howling and tried to sense his presence. Buck stalked into the open, half crouching, body gathered compactly together, tail straight and stiff, feet falling with unwonted care[1]

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to dash away again at the first opportunity.

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Scaffolding for intuitive theories about The Stranger

Read and say each the sentence in your own words. What image do you make?

But in the end Buck's persistence was rewarded; for the wolf, finding that no harm was intended, finally sniffed noses with him. Then they became friendly, and played about in the nervous, half-coy way with which fierce beasts belie their fierceness. After some time of this the wolf started off at an easy lope in a manner that plainly showed he was going somewhere

What does *persistence was rewarded mean* / look like?

What does *the nervous, half-coy way* mean / look like?

What do we know now about the topic? What are some questions we can answer now?

What does each sentence add to the earlier sentences? What is the main idea in this paragraph?

What might happen next?

Why does the writer say: *they ran side by side*?

He made it clear to Buck that he was to come, and they ran side by side through the sombre twilight, straight up the creek bed, into the gorge from which it issued, and across the bleak divide where it took its rise.
.

What does *the sombre twilight* mean?

What does *from which it issued mean*?

What do we know about the text? What do we know now about the *Stranger*?
What are the key ideas in this text?

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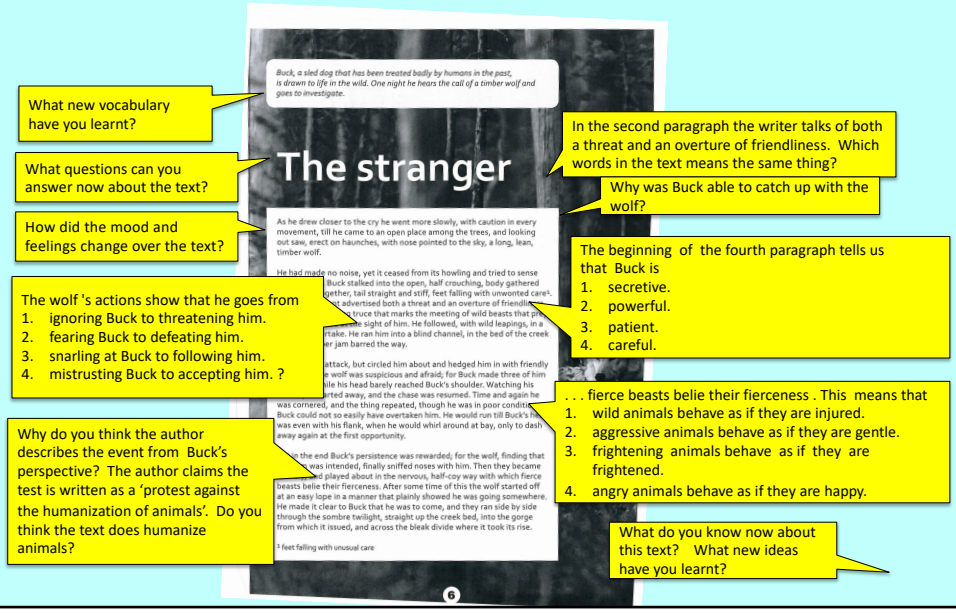
Talented comprehension outcomes



What new vocabulary have you learnt?

What questions can you answer now about the text?

How did the mood and feelings change over the text?

The wolf 's actions show that he goes from
1. ignoring Buck to threatening him.
2. fearing Buck to defeating him.
3. snarling at Buck to following him.
4. mistrusting Buck to accepting him. ?

Why do you think the author describes the event from Buck's perspective? The author claims the test is written as a 'protest against the humanization of animals'. Do you think the text does humanize animals?

In the second paragraph the writer talks of both a threat and an overture of friendliness. Which words in the text means the same thing?

Why was Buck able to catch up with the wolf?

The beginning of the fourth paragraph tells us that Buck is
1. secretive.
2. powerful.
3. patient.
4. careful.

. . . fierce beasts belie their fierceness . This means that
1. wild animals behave as if they are injured.
2. aggressive animals behave as if they are gentle.
3. frightening animals behave as if they are frightened.
4. angry animals behave as if they are happy.

What do you know now about this text? What new ideas have you learnt?

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Your turn

Evaluate the teaching procedures recommended in this part:

- To what extent do you judge them to be applicable to learning and teaching in all domains? What could it contribute to
  - Your planning?
  - How you implement teaching?
  - How you engage in formative assessment of students' learning?
- To what extent does your school currently see the development of high level reading comprehension strategies as part of a pathway to developing talented outcomes?
- How would you recommend the set of teaching procedures be improved?

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How can teachers plan more advanced levels of understanding of a topic?

To plan the higher levels of knowledge and skill, the teacher can either

- select and use higher grade existing content that is taught
- create more sophisticated and advanced versions of content they are teaching to the regular students.

Both are version of whole-grade or subject-specific acceleration and includes compacting the curriculum.

To plan and create more advanced versions of the knowledge, teachers can:

- select the key concepts within the topic
- think about them divergently
- infer how each concept might change
- analyse and evaluate the emerging ideas
- synthesise them
- describe them as a curriculum goal.

Specify explicitly what the regular students will learn.

Identify the main concepts and ideas in this.

Imagine how the ideas might change, infer possible relationships

Synthesise the possible relationships into a theory. This is the more advanced understanding the gifted students can learn. It may match topics in the curriculum.

Describe the target understanding as a curriculum goal.

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How to specify higher levels of knowledge

How do trees breathe and produce food? Structure of leaves, the functions that occur and photosynthesis

Regular Year 7 understanding of the topic VCSSU093

- describe the structure of leaves and the various functions that occur.
- describe photosynthesis and the ingredients of the reaction $6H_2O + 6CO_2 + light \rightarrow C_6H_{12}O_6 + 6O_2$ They comprehend the process for particular leaves.

Identify the main concepts and ideas in this.

Main elements here :
- structure of leaves
- chemical in the reaction: H_2O, CO_2, light, $C_6H_{12}O_6$. O_2

Vary each concept to infer, Imagine how it might change, infer possible relationships or patterns

How is photosynthesis affected by
- features of a leaf such as its size, its shape, structure? Are some leaves more efficient?
- the intensity and colour of the light, the time for which it impacts the leaf?
- the effect of temperature, the climate in which the tree is growing,
- the amount of CO_2, a leaf , the number of chloroplasts in a leaf?

Synthesise the possible relationships into an ITA the more advanced understanding the gifted students can learn.

- How have leaves adapted to photosynthesis? How is the cell structure linked with the chemistry of photosynthesis and respiration?
- Identify the effect of climate change of photosynthesis and some of the limiting factors on photosynthesis. How is it linked this with the health of a plant?
- Analyse photosynthesis in water and ocean plants, green sea slugs and in bacteria.

Describe the target understanding as a curriculum goal.

This matches plant biology, biochemistry, and ecosystems in VCE Biology Units 1–4).

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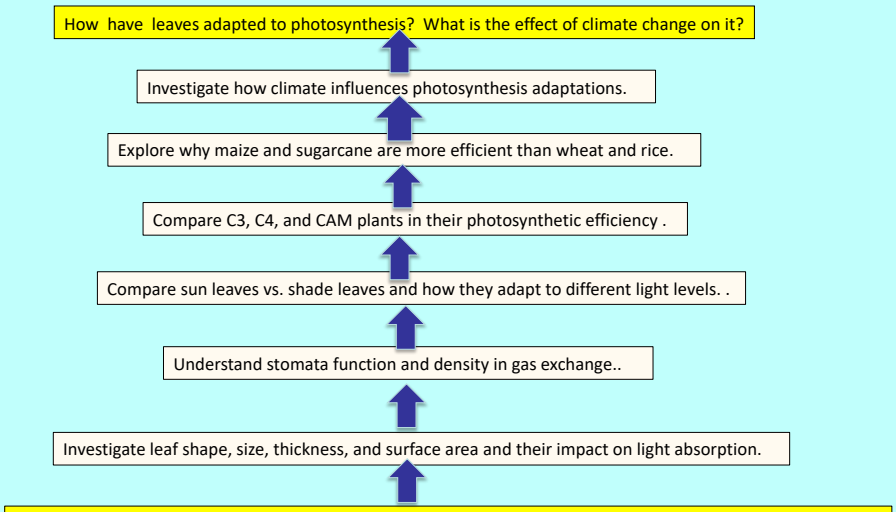
Planning and implementing the differentiated curriculum component.



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A knowledge pathway to the higher level understanding

How have leaves adapted to photosynthesis? What is the effect of climate change on it?

Investigate how climate influences photosynthesis adaptations.	Photosynthesis Efficiency Debate: Students research and argue which plant type is the most efficient.	YouTube Video: C3 vs. C4 Plants Explained
Explore why maize and sugarcane are more efficient than wheat and rice.	CAM Plant Experiment: Keep a cactus in a sealed jar overnight and test for oxygen production.	Cornell University Plant Science: Photosynthesis Efficiency in Crops
Compare C3, C4, and CAM plants in their photosynthetic efficiency .	C3 vs. C4 Plant Comparison: Research how C4 plants like corn and sugarcane perform better in hot, dry environments	C3 vs. C4 vs. CAM Plants – Khan Academy: C3, C4, and CAM Photosynthesis
Compare sun leaves vs. shade leaves and how they adapt to different light levels. .	Sun vs. Shade Plant Investigation: Compare photosynthesis rates in different light conditions using leaf disks.	YouTube Video: Why Are Leaves Different Shapes?
Understand stomata function and density in gas exchange..	Stomata Density Experiment: Use nail polish and tape to make stomatal impressions and count under a microscope.	University of Melbourne – Plant Science Resources: Plant Adaptations
Investigate leaf shape, size, thickness, and surface area and their impact on light absorption.	Examine different leaves (broadleaf, needle-like, succulents) and predict their photosynthesis efficiency. .	Science Direct Article: Leaf Adaptations for Photosynthesis American Journal of Botany: How Leaves Adapt

Describe the photosynthesis reaction and the structure of leaves and the various functions that make it happen

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Individual learning plans

You can use this sequence of questions to plan qualitatively different differentiated curriculum outcomes in any domain for gifted students. Together with the differentiated knowledge pathway, the 13 steps comprise an Individual Learning Program or IEP for gifted students.

The planning decisions

How will you identify the advanced outcomes and the knowledge pathway?

How will you identify the students who will engage in the project?

What provocations and challenges will you use?

In what context/s will the student learn?

How will you guide students to create and evaluate their personal intuitive theories of action?

What types of information sources and learning activities will you use?

How will you group students to learn throughout this component

How will you support students to learn independently and give them boundaries?

How will you guide students to regularly monitor their progress?

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Knowledge pathway to a talented interpretation

What reading comprehension interpretations do Level 5 students make of narrative texts such as "Boy" by Roald Dahl?

1. Analyze themes—identify and discuss broader themes such as childhood resilience, impact of authority figures, justice/injustice.
2. Evaluate the author's perspective—recognize how storytelling style shapes readers' perceptions.
3. Compare historical and modern experiences—contrast experiences across time.
4. Assess bias and reliability—evaluate the accuracy and reliability of storytelling.
5. Examine literary techniques—critique use of irony, exaggeration, humour, and descriptive language

Creative Interpretation that synthesizes analytic and evaluative interpretations and extends themes into new formats

Evaluative interpretation that includes comparison with other texts across time and place, multiple perspectives.

Interpretation that includes analytic aspects of characters, motives, cause-effect, themes, techniques, perspectives

Interpretation that includes deeper inferences, examining character relationships, linking emotions to events

Foundation literal understanding, basic inference, structure and language

1. Explain how text structures assist in understanding the text.
2. Understand how language features, images, and vocabulary influence interpretations of characters, settings, and events.
3. Analyse and explain literal and implied information from a variety of texts
4. Describe how events, characters, and settings in texts are depicted and explain their own responses to them.

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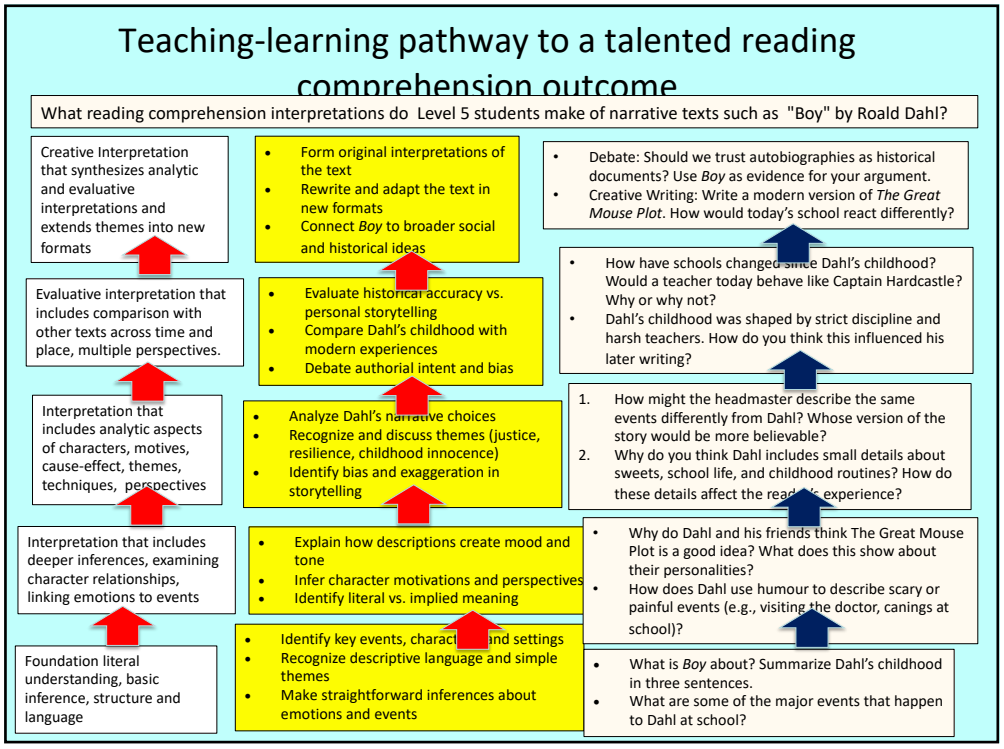
Teaching-learning pathway to a talented reading comprehension outcome



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Talented outcomes in an English project

Following a year-long study of texts that examine perspectives on the topic of Heroes, Year 7 students wrote a text response to : What does it mean to be a hero? They were given one of two cues: either the 4 titles or 4 images from the texts. Their comprehension of a hero from their reading is shown in the following

	Indicators in a student's response
literal	A hero is someone who rescues someone else. Recount one characteristic action, for example, Roald Dahl as a hero to his friends because….
Identify pattern	There is a problem that needs to be solved – complication. Someone is in trouble/ problem Recounts several separate examples/ characteristics of being a hero and integrates them Does the action always involve rescuing? Types of heroes: sporting/personal/national/individual
Trend	Why might someone choose to act like a hero? Do they always choose to or do circumstances choose them? What are these? How is being a hero affected by the culture a person is in? Can you create a hero of yourself? What role do others play in shaping a hero? Can females be heroes? Is a hero always an individual – can it be a group? Links characteristics to a common good?
Question trends	Can anyone be a hero? Why do some people act in this way? Is there a pattern in the circumstances?
Formulaic learner	What events/circumstances reveal a hero? Is there a pattern, set of circumstances? A hero could be someone who does not act. Is it a conscious act? When? I versus fight – human instinct A hero demonstrates particular qualities or characteristics consistently. What are these qualities? What are the characteristics of a hero? Who decides if someone is a hero?
Rules	How do we recognise heroes in our society, eg. publicly? Why do we value heroes? When? Hero to some, not to others. One man's freedom fighter is another's terrorist, e.g. Ned Kelly, Nelson Mandela
Ethical	Why does a culture value heroes? Why should we? How do they fit in the norms, values in society? What dangers are possible when we have /don't have heros? How is being a hero linked with self interest. What would happen if everyone acted out of self interest

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Talented outcomes for Level 4 place value

Place value is an arbitrary grouping of numbers, any base 10 number can be expressed in other bases, how to count do arithmetic calculations, problem-solve in different bases, use different number bases in real-world applications

- count in different bases eg, base 3, 4, 6.
- Use place value in algebra, for example, x^2-5x+4 + $3x^2$+8x+9
- Apply number bases to real-world applications (e.g., cryptography, computing, alternative measurement systems).
- Convert between base 10 and other bases (e.g., octal, hexadecimal), eg,, $37_{10} \rightarrow ?_8$ and between other bases
- addition and subtraction calculations in different bases (e.g., add base numbers), e.g., $1101_2 + 101_2$

subtract in base 9 or 11 for example
74232 $_{nine}$ and 74232 $_{eleven}$
-38743$_{nine}$ -38743$_{eleven}$

VCE Mathematics Methods (Units 1–4), Topic 1: Number Systems (Unit 1) the concept of number bases, the binary system, octal system and hexadecimal systems

Describe the target understanding as a curriculum goal.

Synthesise the possible relationships into a theory.

Imagine how the ideas might change, infer possible relationships

Other grouping, bases, extend place value, how are arithmetic operations affected

Identify the main concepts and ideas in this.

10 –grouping, base 10 place value, arithmetic operations

Specify explicitly what the regular students will learn.

Level 4: Apply an understanding of place value to partition, rearrange and regroup numbers to at least 10 000 to assist in calculations and solve problems. (**V9M4N02)**

- rearrange 10 grouped quantities, decompose numbers using place value
- regroup and rename numbers during operations for example subtraction

solve tasks
74232
-38743

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Knowledge pathway for Level 4 place value

Place value is an arbitrary grouping of numbers, any base 10 number can be expressed in other bases, how to count do arithmetic calculations, problem-solve in different bases, use different number bases in real-world applications

What is the rule for using place value?

Use the outcomes of base 9 and base 2 to predict outcomes in other bases

Apply and use place value and partitioning in base 9 and base 2

Level 4: Apply an understanding of place value to partition, rearrange and regroup numbers to at least 10 000 to assist in calculations and solve problems. (**V9M4N02)**

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Knowledge and learning pathway for Level 4 place value

Place value is an arbitrary grouping of numbers

- Do all number systems use place value? What is place value system in Roman numerals .
- Explain how to count do arithmetic, problem-solve in different bases eg, base 3, 4, 6.
- How do the bases affect multiplication and fractions.
- Where is place value in algebra, for example, x^2-5x+4
- Apply number bases to real-world applications (e.g., cryptography, computing, alternative measurement systems).

What is the rule for using place value?

- Understand the concept of a base (why base 10 uses digits 0-9, and base 2 uses only 0-1) and that any base works by powers of that base, interpret a multi-digit number in any base
- Explain how base 10 system is just one possible number system.
- How does the number of digits in a place value system affect which tasks will give you the same outcome for an operation
- Recognize place value in different bases and how they work (e.g., binary, octal, hexadecimal)
- sometimes you get .don't get the same outcome for different bases when you subtract. How do the two types of tasks differ ?

Use the outcomes of base 9 and base 2 to predict outcomes in other bases

- Convert between base 10 and other bases (e.g., octal, hexadecimal), eg,, 37_{10} → $?_8$ and between other bases
- What notation would you use for each base?
- Do addition and subtraction calculations in different bases (e.g., add base numbers), e.g., $1101_2 + 101_2$

subtract in base 9 or 11 for example

74232 $_{nine}$ and 74232 $_{eleven}$

-38743$_{nine}$ -38743$_{eleven}$

Apply and use place value and partitioning in base 9 and base 2

- Re-arrange 10 grouped quantities into matching 9- grouped and 2- grouped quantities,
- say the number of digits used in each system
- convert to and write numbers in bases 2 and 9, 13_{10} to base 2
- use the appropriate notation to specify the quantity in each case
- Use in addition and subtraction tasks
- Explain why computers and digital systems use binary (base 2).

Level 4: Apply an understanding of place value to partition, rearrange and regroup numbers to at least 10 000 to assist in calculations and solve problems. (**V9M4N02**)

- rearrange 10 grouped quantities, decompose numbers using place value
- regroup and rename numbers during operations for example subtraction

solve tasks

74232

-38743

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Talented outcomes for Level 7 area of triangles

Derive and apply the spherical triangle area formula

Students prove that A= R^2 x SE/180: they

- Imagine the total surface of a sphere divided into small triangles
- Recall that the total area of all of the triangles is 4pR^2 and work out that the total SE is 4 x180xp.
- For any one triangle, the proportion of its area to the total sphere is A/ 4pR^2 and the proportion of its SE to the total sphere is SE/4 x180xp.
- Equate the two proportions and manipulate → A/ 4pR^2 = SE/4 x180xp -> A = R^2x SE/180

They compare their understanding with plane triangle derivations.

They investigate how spherical triangles are used in

- aviation, aircraft navigate and fly along great circle routes, the shortest distance between two points on a sphere.
- astronomy to measure distances between stars,
- GPS mapping by triangulating signals from multiple satellites to pinpoint locations.
- Satellites to determine positions on Earth.
- Cartography to calculate actual areas of regions rather than by using flat maps that distort actuality.

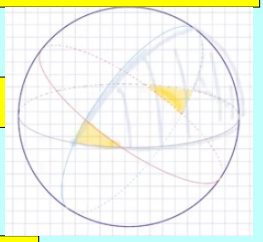
non-Euclidean geometries and applications in VCE Mathematics Methods and Specialist Mathematics

Describe the target understanding as a curriculum goal.

Synthesise the possible relationships into a theory.

Imagine how the ideas might change, infer possible relationships

Change the surface to a sphere



Identify the main concepts and ideas in this.

Area, triangles on a flat surface, side lengths, angles

Specify explicitly what the regular students will learn.

Understand and apply the standard triangle area formula (Year 7 VCMMG258)

-

Work out the area of individual cut-out triangles by cutting a rectangle into two triangles and by using gird paper.

Use and apply : A=1/2 × base × height

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Knowledge pathway for Level 7 area of triangles

Derive and apply the spherical triangle area formula

Find area of spherical triangles by using spherical excess

Triangles on a curved surface - spherical triangles

The unit area on a sphere. Total surface area of a sphere

Straight lines on a sphere versus straight lines on a flat surface

Understand and apply the standard triangle area formula (Year 7- VCMMG258)

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Knowledge and learning pathway for Level 7 area of triangles

Derive and apply the spherical triangle area formula

Students prove that A= R^2 x SE/180: they
- Imagine the total surface of a sphere divided into small triangles
- Recall that the total area of all of the triangles is $4\pi R^2$ and work out that the total SE is 4 x180x π.
- For any triangle, the proportion of its area to the total sphere = A/ $4pR^2$ and the proportion of its SE to the total sphere = SE/4 x180x π. Equate the proportions and manipulate → A = R^2x SE/180

They compare their understanding with plane triangle derivations.
They investigate how spherical triangles are used in
- aviation, aircraft fly along great circle routes, the shortest distance between two points on a sphere.
- astronomy to measure distances between stars,
- GPS mapping by triangulating signals from multiple satellites to pinpoint locations.
- Satellites to determine positions on Earth.
- Cartography to calculate actual areas of regions rather than by using flat maps that distort actuality.

Find area of spherical triangles by using spherical excess

Students explore the link between the SE for a spherical triangle and the radius of the sphere. They use and apply the formula A= R^2 x SE/180.
They use it to calculate areas of triangles on Earth's surface using given angles.
Real-world connection: Explain how this is used in mapping large land areas like countries.

Triangles on a curved surface - spherical triangles

Students draw triangles on large balls/ balloon and measure their angles. They compare the sum of the angles to those on a flat surface (sum to 180) and discuss why it is larger.
Students note how triangles on a sphere are formed by three great circles (e.g., longitude & latitude).
Concept of 'spherical excess' (SE)– how much bigger than 180° the sum is. How does SE affect the area?

The unit area on a sphere. Total surface area of a sphere

How does the unit area on a sphere differ from the unit area on a flat surface?
Students use the formula TSA = $4\pi R^2$ to work out the surface area of spheres.

Straight lines on a sphere versus straight lines on a flat surface

- Investigate differences between straight line on a flat plane and a sphere. What happens to straight lines (geodesics) on a sphere? Straight lines on a sphere are great circles (longitude & latitude).

Understand and apply the standard triangle area formula (Year 7 VCMMG258)

Work out the area of individual cut-out triangles by cutting a rectangle into two triangles and by using gird paper.
Use and apply : A=1/2 × base × height

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Gifted interpretations of states of matter

Year 7 States of Matter: What are the different forms in which an item can exist ?

Highly gifted students Investigate
- how non-Newtonian fluids e.g. paint or cornflour differ from Newtonian fluids and the pro liquid crystals, and foams
- kinetic theory of matter and intermolecular bonds and forces
- Energy is used to change state without changing temperature; latent heat of fusion, vaporisation
- the motion of particles and chemical reactivity, how particles interact with other particles, energy on reaction rate

Evaluation and synthesis into theories

These topics are taught in VCE Physics curriculum

Mildly gifted students Investigate
- the properties of the three states of matter in real life contexts and decide where they would see the different physical states, (e.g., what is glass? What is mantle – slowly flowing solid, the plasticity of solids, sublimation why/how?
- the conditions when a material changes state, the role of energy in making it happen,
  - some solids behave differently when energy/forces are applied, depending on arrangement of particles; how some solids are malleable and/or ductile
  - some substances change while staying in the one shape; graphite changed to diamond

deeper inferences and analysis.

Regular students are taught to
- describe the physical properties of the three states of matter; solids have a fixed shape and can't be squashed, liquids flow and take the shape of its container, gas fill their container and are compressible.
- describe the particle structure of matter; they say what particles are, draw diagrams, describe the motion of particles and the affect of adding/removing heat energy, changes of state.

VCELA

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Knowledge and teaching pathway for talented outcomes in states of matter

Change of state

Encourage problem-solving, independent research, and innovation.

Students design and prototype a phase-change material (PCM)-based cooling system for use in space, emergency shelters, or climate-controlled clothing. They present their findings in a scientific report or video demonstration.

- How do engineers use phase change materials (PCMs) to store and release heat?
- How could this be used in space exploration, extreme climates, or medicine?
- What other scientific advancements rely on understanding phase changes

Explore beyond standard states of matter into scientific frontiers.

- Research how plasma (the fourth state of matter) is used in neon lights, stars, and fusion energy.
- Investigate how scientists create Bose-Einstein Condensates (BECs) by cooling atoms to near absolute zero.

- How is plasma different from gas?
- What is a Bose-Einstein Condensate, and how does it behave differently from regular solids?

What scientific discoveries depend on understanding these extreme states of matter

Apply understanding to practical, industrial, and environmental applications.

- Use a vacuum pump to boil water at room temperature by lowering the air pressure.
- Connect this to how water boils at lower temperatures on Mount Everest and how pressure cookers work.

- Why does water boil at a lower temperature at high altitudes?
- Why do astronauts in space need special cooling systems?
- How does this principle apply to making freeze-dried foods?

Explore latent heat, energy transfer, and real-world examples beyond just temperature changes.

- Students measure the temperature of melting ice over time.
- They plot a temperature vs. time graph and analyze why the temperature plateaus at 0°C despite heat input.

- Why does the temperature stay constant during melting and boiling?
- Where does the energy go if it's not increasing temperature?

How does this relate to real-life situations like sweating or phase-change materials in en ing

Understand the basic concepts of particle motion, temperature, and phase changes

- Use an interactive simulation to visualize how particles behave during melting, boiling, freezing, condensation, and sublimation

- What happens to the speed and arrangement of particles as heat is added/removed?
- Why does the boiling point of different substances vary? How does pressure affect state changes?

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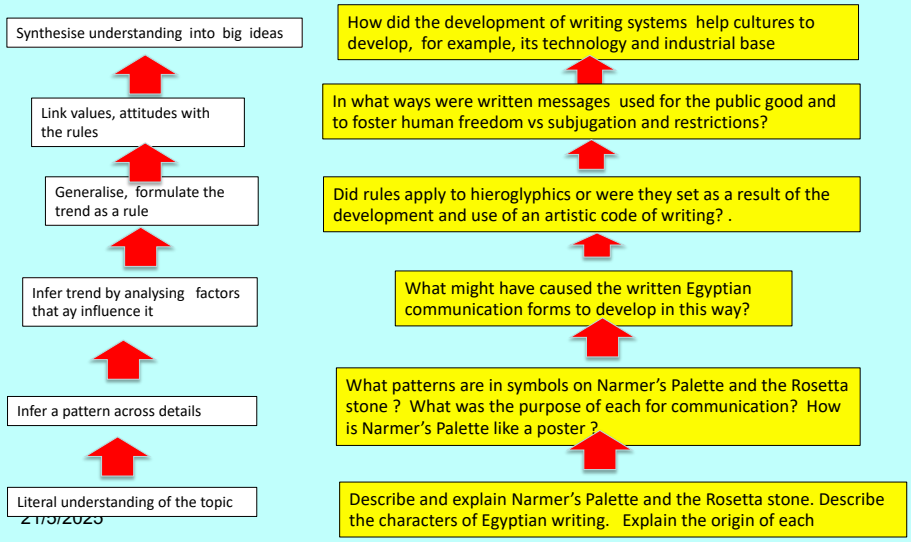
Teaching pathway to a talented history outcome: hieroglyphics

Challenge question: How does hieroglyphics differ from contemporary written languages as a way of communicating? What does it say about the people who used it? The following set of questions guide students develop a more in depth knowledge of Egypt to examine further detail of Egyptian culture



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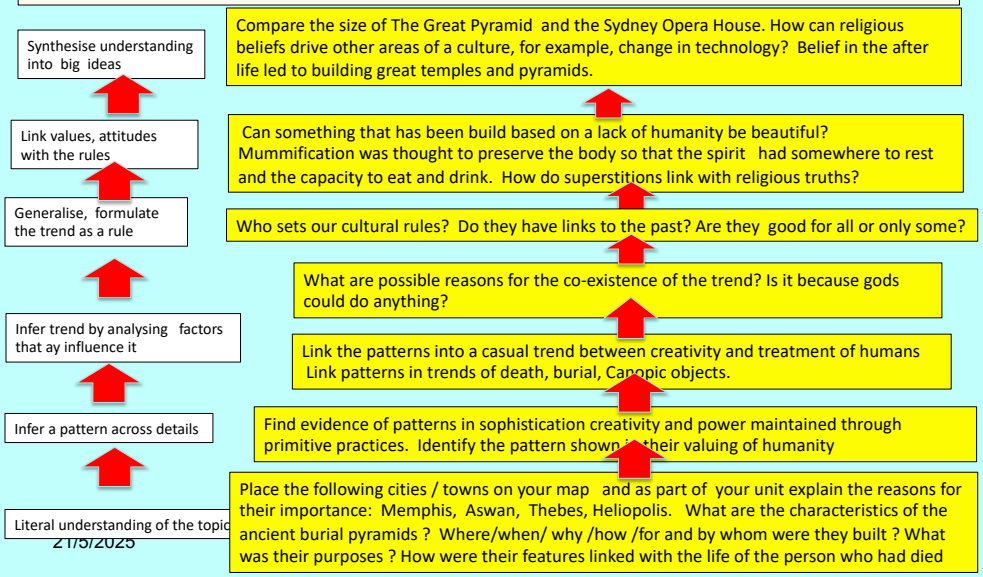
Teaching pathway to a talented history outcome: human values

Human values + Religion How is it that in a culture so highly sophisticated as ancient Egypt can at once be so creative and punitive? How did ancient leaders need to evoke the concept of 'god' ? How did they use it to maintain their position of power, their aloofness?



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Your turn

A challenge teachers frequently face is how to create higher levels of understanding of a topic that could interest and challenge gifted students. How could you apply the procedures discussed here to topics you will teach in the next few months. Examine the following:

- How could you frame up or create more intellectually complex versions of topics you will teach?
- How will you engage nonverbally and practically gifted students in pursuing this higher level understanding?
- How will you engage twice exceptional students in the consolidation process?
- What resources could assist you to frame up these higher levels of understanding?
- How could you link these higher levels of understanding with the curriculum?
- How often do teachers in your currently plan more advanced versions of the topics that they use with the gifted students in their classes?

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Review the day: Your turn

The focus of today's workshop has been on making gifted learning and talent development explicit in the regular classroom and to optimize the likelihood that the understanding of gifted students at any time will be recognized, valued and respected in the classroom.

- How important is it that it be made explicit and visible?
- Identify ways in which the workshop has added to your knowledge of how to cater for gifted learning and talent development in the regular classroom.
- How will your provision for these students be different in the future?

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Q & A

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Thank you for travelling this journey with me today.

My very best wishes with your important work in this area in the future

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