GRIFFITH UNIVERSITY

Queensland Australia

Generative Artificial Intelligence-Enhanced Pedagogical Approaches for Gifted Learners

QAGTC 2025 State Conference Keynote Address

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MAKE IT MATTER

Come with Me on a Journey…

Gifted Education Meets the Age of AI…

Persistent challenges for twice-exceptional and gifted learners

Need for personalised, learning approaches

GenAI as potential partner…

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My “cognitive partner”

Claude

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Redefining the Box - The Hammer Experiment

- "***If the only tool you have is a hammer, you tend to see every problem as a nail***"- (Maslow)
- Refers to a concept commonly known as the *'law of instrument*' or *Maslow's Hammer*
- An *over-reliance on a familiar or favourite tool* or approach to…

- **Moving beyond "When all you have is a hammer..."**
  - Used Claude AI to generate 101 alternative uses for a hammer
  - Demonstrated how GenAI can support gifted students and their teachers to move beyond conventional thinking…

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🔨 Selected Unconventional Hammer Uses and Gifted Education Alignment

Hammer as a Tuning Fork

Gifted characteristic: Sensory sensitivity, heightened aesthetic awareness

Educational insight: Encourages students to explore *non-obvious properties* of familiar objects. Promotes acoustic experimentation, resonance, and metaphorical thinking

Hammer as a Storytelling Artifact

Gifted characteristic: Advanced verbal expression, narrative thinking

Educational insight: Invites symbolic/metaphorical use—gifted learners may personify or historicise the hammer. Encourages myth-making, historical fiction, and narrative divergence

Hammer as a Symbol of Constraint or Power

Gifted characteristic: Justice sensitivity, abstract ethical reasoning

Educational insight: Sparks dialogue around symbols, authority, and control. Can lead into philosophical inquiry or political debate—e.g., "Who decides what a tool *should* be used for?"

Hammer as a Musical Instrument

Gifted characteristic: Divergent creativity, inter-domain connections

Educational insight: Demonstrates lateral thinking. Supports STEAM-based inquiry—physics of percussion, sound design, or musical improvisation using everyday objects

Hammer as a Tool of Delicate Precision

Gifted characteristic: Intensely focused curiosity, deep-dive interest in niche topics

Educational insight: Breaks stereotype of "blunt force"; reframes tools as capable of nuance. Encourages cross-disciplinary applications (archaeology, medicine, materials science)

“Adjacent Possibles”…

- **Key Finding: ‘Adjacent Possibles’**
  - GenAI creates what Kauffmann (2023) calls "adjacent possibles"
  - For gifted students: 101 adjacent possibles to build on
  - For teachers: Less time generating possibilities, more time guiding exploration

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From Constraints to Creativity…

"Sometimes a simple tool used skillfully by an ingenious person is the best approach“

- **Shift from literal to metaphorical, creative to analytical**
- What started as a playful challenge became deep dive into how GenAI models ‘think’—from concrete to abstract
- Revealed **how GenAI can support modelling of complex thinking for gifted learners**
- Began the **process of pedagogical exploration** with GenAI for supporting gifted education and talent development

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Insights from the Hammer Experiment…

- **Metaphor, Constraint, and Imaginative Thinking**
- '**Closed World Principle**' - creative thinking strategy - encourages **innovation** by **reimagining** new functions for existing tools without introducing new elements—as demonstrated in the hammer experiment to guide gifted learners toward **deeper creativity**
- **Systematic Inventive Thinking** - structured creativity method - uses specific patterns—e.g., subtraction, division, attribute dependency—to generate innovative ideas
- **AI as model and partner for divergent thinking**
- **Implications for gifted pedagogy**…

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“Project Zephyr” - Pushing Creative Boundaries

- **Imaginative Learning Journey**
  - Created a fictional scenario about human-powered flight
  - GenAI initially hesitant → evolved into rich, complex exploration
- **Cross-Disciplinary Connections**
  - Integrated physics, biology, psychology, and more
  - Supported the depth and complexity gifted learners need
- **Metacognitive Development**
  - Revealed biases in character creation (e.g., gender and cultural assumptions)
  - Led to discussions on critical thinking about representation and inclusion

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Project Zephyr as a Case Study

- A sophisticated secret program seeking individuals with **extraordinary potential**
- We developed intricate narratives about recruitment strategies
- Exploring how to identify candidates through subtle means - from specialized VR games to covert observation of practitioners in various fields
- Project evolved to consider **unconventional sources of human potential**, looking beyond physical capabilities to explore consciousness, perception, and the untapped realms of human experience

- Gifted Learning in the 'Imaginative Mode'
- "*What if..*" scenarios
- Depth, complexity, bias recognition
- Cross-disciplinary learning
- "Zephyr showed what gifted pedagogy might look like in the age of AI - When we take limits off

What if Teachers Could *Rehearse Pedagogy* like this?

- Project Zephyr → question: How can GenAI support teachers in gifted education and talent development?
- Led to next research phase…
- Rehearsal before classroom implementation

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Overview - Experimenting with GenAI to Create Personalised Learning Experiences for Twice-/Multi-Exceptional Students…

- Many classrooms **struggle to meet complex requirements of twice-/multi-exceptional** neurodivergent students
- **Small-scale experiments** with GenAI models
- We **developed and used synthetic learner profiles** to simulate pedagogical scenarios for personalised learning
- GenAI apps tested as model for teacher ***pedagogical rehearsal*** of inclusive, differentiated teaching approaches

(Ronksley-Pavia, Ronksley-Pavia, & Bigum, in press)

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Small-Scale Experiments – What We Did…

1. Literature review – strengths-based approaches for supporting twice-/multi-exceptional learners
2. Synthetic learner profile development
3. Pedagogical rehearsal using synthetic learner profiles
4. Assessing outputs against evidenced-based approaches…
5. Implications for practice

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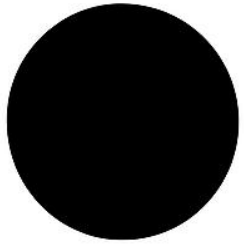
Generative AI Software Marketscape

ChatGPT



Claude

NotebookLM

The two AI Assistants (Chat Bots) we Used

So called “Knowledge Management” app that we Used

Strengths-Based Approaches from Literature Review for Supporting Twice-Exceptional Learners

Differentiated Instruction - Element	Key Components	Some Implementation Strategies
Content Differentiation		
• Compacted curriculum • Advanced content options	• Varying levels of complexity • Choice in content depth • Interest-based extensions • Compacted curriculum for mastered content	• Multiple entry points to content • Pre-assessment to identify mastery of concepts • Problem-based learning tasks at varied levels • Real-world applications aligned with interests • Cross-disciplinary connections • Technology-enabled personalised pathways • Advanced material replacement strategies
Process Differentiation		
• Varied learning activities • Multimodal instruction	• Flexible pacing • Student choice in engagement • Scaffolded support • Multiple instructional approaches • Varied learning activities • Choice in how to engage + content	• Multiple instructional approaches • Technology and software • Graphic organisers • Choice menus • Hands-on simulations • Student-led inquiry and problem-based projects
Product Differentiation		
• Choice in demonstration of learning • Creative output options Alternative assessment options Varied complexity levels in outputs	• Multiple modes of expression • Varied complexity levels • Strength-based sharing	• Alternative assessment options • Multimedia options • Digital portfolios • Performance-based assessment • Arts representations • Technology-enhanced products • Project-based outputs
Learning Environment		

• Social-emotional supports
• Organizational structures
	• Physical modifications
	  • Safe spaces
	  • Visual cues
		• Flexible seating
		• Self-regulation zones
		• Visual cues and schedules

• Sensory considerations	• Technology integration	• Technology-enhanced work areas • Executive function supports • Strength celebration strategies • Clear routines and transitions

Strengths-Based Approaches from Literature Review for Supporting Twice-Exceptional Learners cont.

Dimension	Key Components	Implementation Strategies
Acceleration Approaches		
• Grade-based acceleration • Single-subject acceleration • Advanced placement courses • Content-based acceleration • Curriculum compacting • Dual enrolment	• Iowa Acceleration Scale implementation • **Subject-based acceleration** • Early entrance options • Independent study pathways • **Mentorship programs** • Structured acceleration planning	• Single-subject advancement • Cross-grade subject grouping • Online advanced coursework • Expert mentorship programs • Independent study pathways • Credit by examination options
Grouping Practices		
• Interest-based grouping • Learning profile grouping • Cluster grouping	• Readiness grouping • **Project collaborations** • **Peer connections** • **Cross-grade interest groups**	• Fluid and flexible groups • Targeted instruction • Progress monitoring • Pre-assessment informed grouping • Regular regrouping processes • Interest-based collaborations • Expert group formation • Flexible timeline approaches

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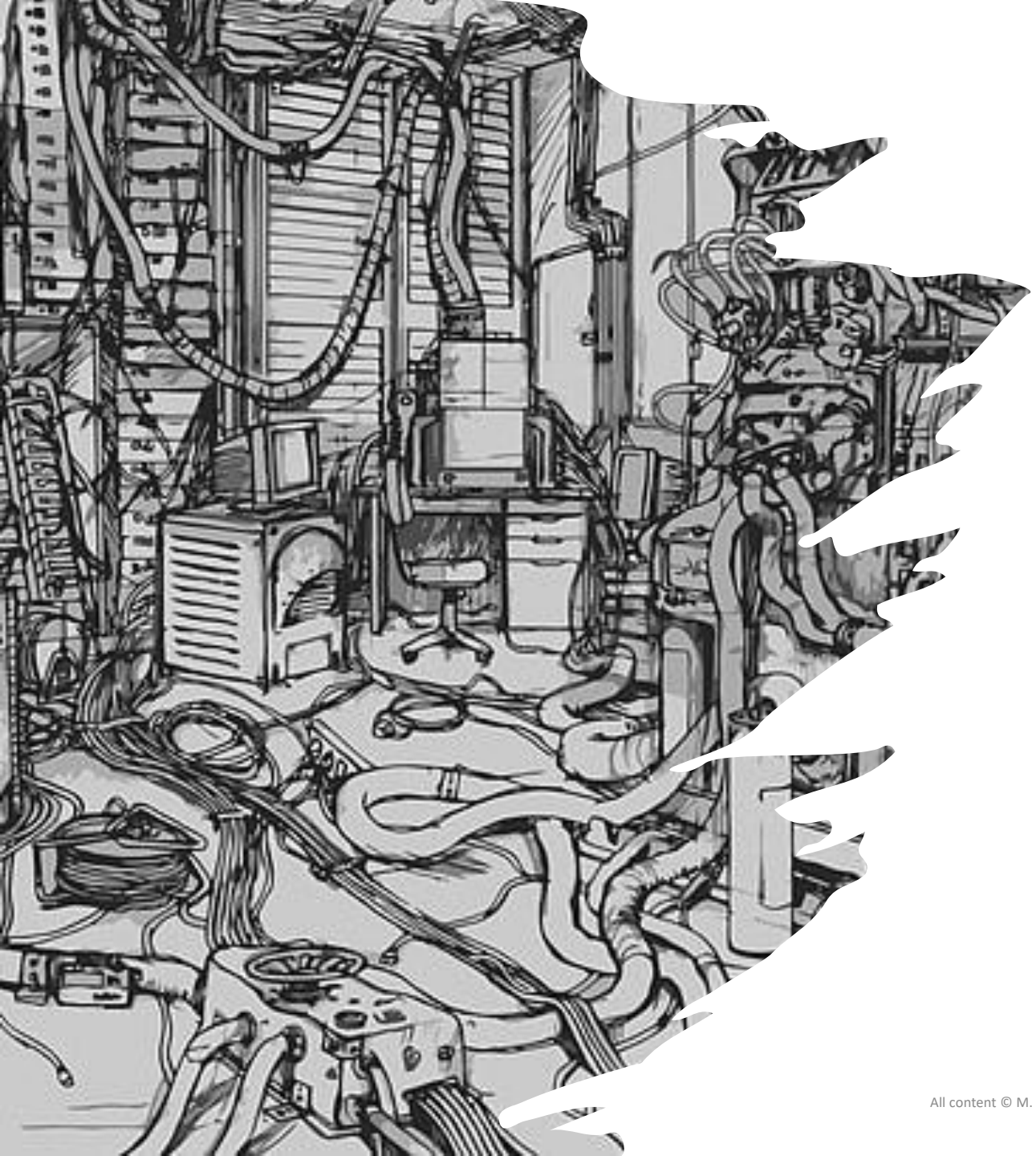

Synthetic Profiles – Small-Scale Experiments

- **Twice-/Multi-Exceptional Learner Profiles**
  - Created synthetic learner profiles using different GenAI tools
  - Based on real-world students
  - Evidence-informed profiles of fictional or synthetic twice-/multi-exceptional students

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Synthetic Multi-Exceptional Learner Profile Development

Phase	Purpose	Example Prompt	Outcome	Refinement Needed
Initial Profile Creation	Create synthetic learner profiles based on real examples	"Now that you have analysed these real profiles, I would like you to create two fictional synthetic, composite student profiles..."	Basic profile of multi-exceptional students (6 profiles: 2 each from Claude, ChatGTP and NotebookLM)	Initial profile lacked depth in identification journey and timeline
Profile Development	Expand understanding of identification journey	"Could you also let me know at what age or grade level each of these students were diagnosed..."	Timeline of diagnoses and professional involvement created	Needed more detail about specific professionals and process
Identification Process	Detail the diagnostic journey	"Please expand on the profiles with this additional information, mentioning what led to seeking additional diagnoses..."	Comprehensive timeline with initiators, practitioners, and reasons for each diagnosis; including demographics, cognitive assessment, diagnoses	Required integration into cohesive profile narrative
Subject Strategy Development (literacy and numeracy)	Develop targeted, strengths-based teaching strategies	"I would like you to come up with strategies that a teacher may be able to use for supporting..."	Initial broad strategies for literacy and numeracy teaching	Too generic, needed more specificity
Review remaining profiles, reduce to 4, then to 2	Develop specific targeted strengths-based pedagogical approaches	"I would like you to come up with personalized approaches specific to [profile] these must be targeted..."	Continued iterations of teaching approaches pushing for more personalised approaches	Pushing for tailored approaches
Subject-Specific Strategy Development (History)	Develop targeted strengths-based teaching strategies	"I would like you to come up with personalized approaches that a [high/elementary] school history teacher may be able to use for supporting [profile]..."	Initial broad strategies for history teaching	Further pushing for personalized approaches specific to 2 profiles
Strategy Refinement	Make strategies more specific to profile	"These do not give me sufficient detail for what a teacher could do in practice..."	More detailed implementation examples for history unit/class	Still needed explicit connections to profile
Explicit Profile Connection	Connect strategies to specific aspects of profile	"Show me through elaborating on one key strategy...how the selected approach specifically supports [profile's] needs..."	Detailed analysis of how strategies support both challenges and giftedness – strengths-based	Required broader evidence base
Evidence-Based Analysis	Ground strategies in research literature	"Using the attached documents...I would like you to analyse and critique your suggested strategies..."	Evaluation of strategies against evidence-based practices from literature review and analysis	Final synthesis of practical applications

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Final Multi-Exceptional Synthetic Learner Profiles…

Ava Chen (ChatGPT)	Ethan Rodriguez (Claude)
Age: 14	**Age:** 11 (Garde 6)
Background: Chinese-American, 8th grade	**Background:** Latino, 6th grade
Giftedness: Exceptional in **mathematics**; excels in **visual-spatial and fluid reasoning**; strong **abstract problem-solving**	**Giftedness:** Excels in **perceptual reasoning** (99.9th percentile); **strong verbal skills;** advanced **logical reasoning**
Disabilities: Dyslexia, Autism Spectrum Disorder (ASD), Sensory Processing Disorder (SPD)	**Disabilities:** ASD (Level 1), Sensory Processing Disorder, Dysgraphia
Cognitive Profile: High visual-spatial/non-verbal abilities; lower verbal comprehension, working memory, processing speed	**Cognitive Profile:** Very high perceptual reasoning; low processing speed; significant strengths and challenges
Supports: Text-to-speech, audiobooks, visual aids, manipulatives, structured routines, noise-cancelling headphones	**Supports:** Structured environment, technological tools (e.g., speech-to-text), STEM-integrated tasks, graphic organizers
Challenges: Struggles with reading, writing, sensory overload, and social interaction	**Challenges:** Slower task completion, fine motor difficulties, sensory regulation, social communication
Implications for Pedagogy: Structured learning; supports must scaffold written output; talent development needs strengthening	**Implications for Pedagogy:** Integrated STEM learning opportunities; scaffolded written expression; high cognitive engagement with adjustments

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Claude Even Provided WISC-V Results for Ethan…

WISC-V Index	Score	Percentile	Descriptive Category
Full Scale IQ	135	99th	Very Superior
Verbal Comprehension	131	98th	Superior
Perceptual Reasoning	150	99.9th	Very Superior
Working Memory	110	75th	High Average
Processing Speed	81	10th	Low Average

And a Diagnosis Timeline…

Age	Grade	Identification/Diagnosis	Initiator	Practitioner
4	Preschool	- Identified as potentially gifted - Diagnosed with Sensory Processing Disorder	Teacher	Occupational Therapist
5	K	- Diagnosed with Autism Spectrum Disorder (Level 1)	Teacher and Parents	Developmental Pediatrician
7	2	- Formally identified as gifted (WISC-V) - Diagnosed with dysgraphia	Teacher (gifted), Parents (dysgraphia)	Educational Psychologist, Occupational Therapist
8	3	- Formally recognized as twice-exceptional (multi-exceptional)	Parents	Neuropsychologist

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Pedagogical Rehearsal with Synthetic Profiles – Small-Scale Experiments

- **Testing Pedagogical Approaches**
  - Teachers can "rehearse" strategies before implementation
  - Experimented across curriculum areas (e.g., history, literacy)
  - Identified strengths and gaps in GenAI-generated approaches

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Comparison of GenAI Recommendations and Alignment with Evidence-Based Practices for each Profile – Differentiation Example…

Evidence-Based Practice	Ethan's Profile (Claude)	Ava's Profile (ChatGPT)	Alignment with Literature
Curriculum Differentiation			
Content	Integration of STEM principles in historical analysis; Mathematical modelling of historical events	Visual aids, timelines, maps for content accessibility	Strong alignment for content modification
Process	Digital tools for written work; Programming-based historical analysis	Multimodal presentation; Audio versions of texts	Good alignment with process adaptation
Product	Alternative assessment options; Technology-enhanced presentations	Multiple formats for demonstrating learning	Strong alignment with product variation
Learning Environment	Structured workspace; Sensory considerations; Clear routines	Modified environment for sensory needs; Quiet spaces	Strong alignment with environmental modifications

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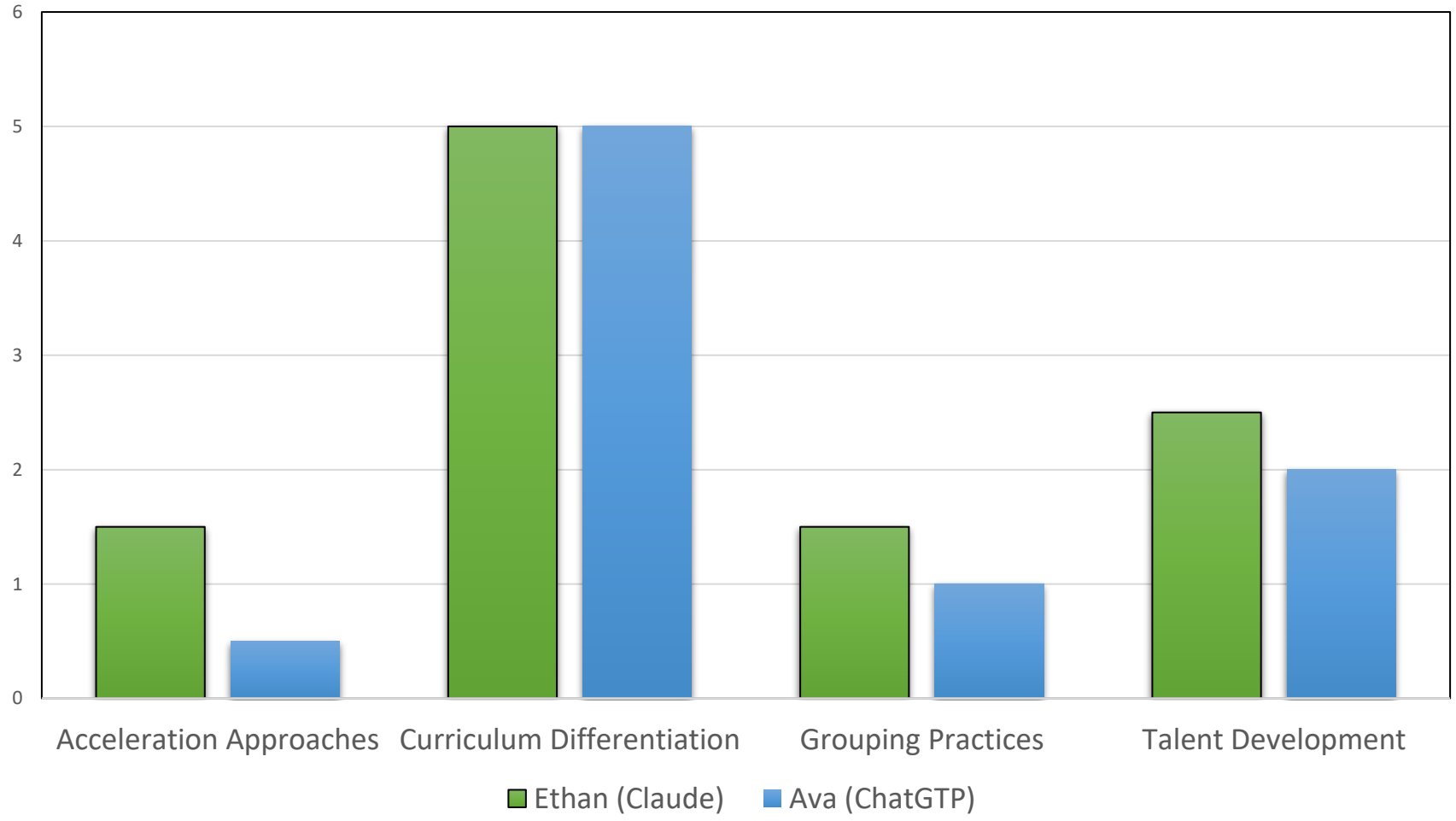
Strengths and Weaknesses of the GenAI Recommendations for each Profile



Note: 5-point scale - 0 indicating limited alignment up to 5 indicating full alignment with literature evidence-base

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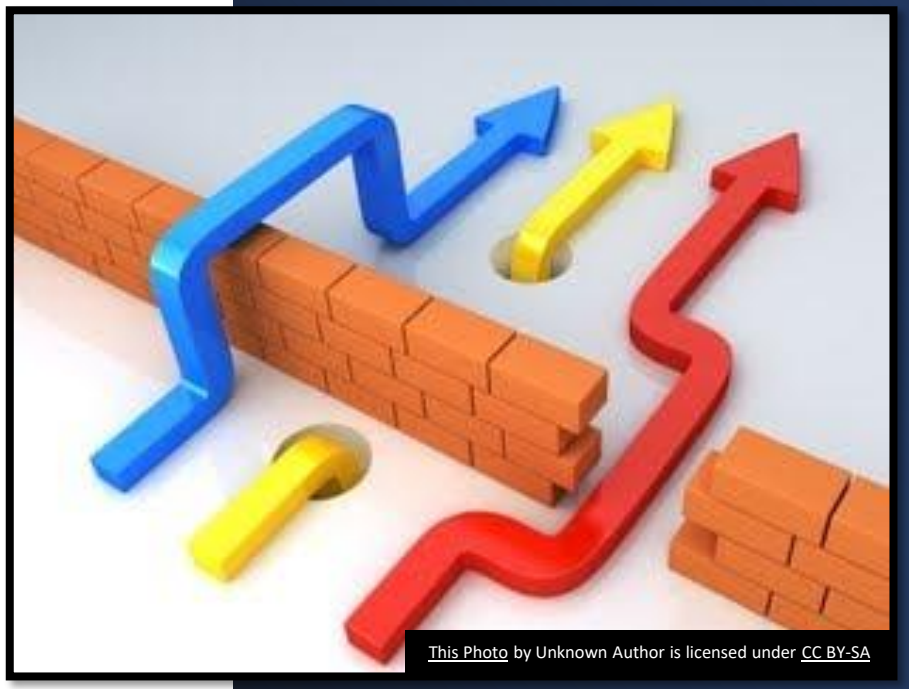
Pedagogical Rehearsal with Synthetic Profiles – Small-Scale Experiments

- **Key Findings:**
  - Strong on **content differentiation and environmental** modifications
  - Weaker on **acceleration planning and social-emotional support**
  - Provided foundation for teacher professional development



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Some Practical Implications for Educators…

- From AI novelty to pedagogical rehearsal
- Almost risk-free rehearsal
- Synthetic profiles for teacher PD
- Toward co-designed GenAI PD environments
- Not science fiction - a practical approach for teacher PD
- Where GenAI can play role of tireless *cognitive partner* and scenario generator

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Some Critical Considerations…

- Bias in GenAI profiles
- Importance of inclusive, strength-based framing
- Ethical considerations
- Need to guide models, not be guided by them
- Importance of human oversight
- Means critically engaging with their outputs

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GenAI and Gifted Education…

Capability	What it can do…
Multimodal Resource Production	Creates written, visual, and audio materials—such as reports, lesson content, and presentations
Language Processing & Summarisation	Translates between languages and condenses detailed content into digestible summaries
Creative Thinking Partner	Sparks ideas for lesson planning, inquiry tasks, and research design
Workflow Efficiency	Handles routine tasks like drafting messages, feedback, and templates to save time
Insight Extraction from Data	Makes sense of data patterns—turns complex student data or research findings into clear insights
Context-Aware Virtual Assistants	Acts as specialised support—like a tutoring bot or digital guide tailored to specific domains
Educator Practice Lab 🆕	Supports teacher to trial and refine strategies with simulated learners in a relatively risk-free space
Adaptive Support for Learner Diversity 🆕	Responds to student profiles with tailored feedback, scaffolds, and learning pathways

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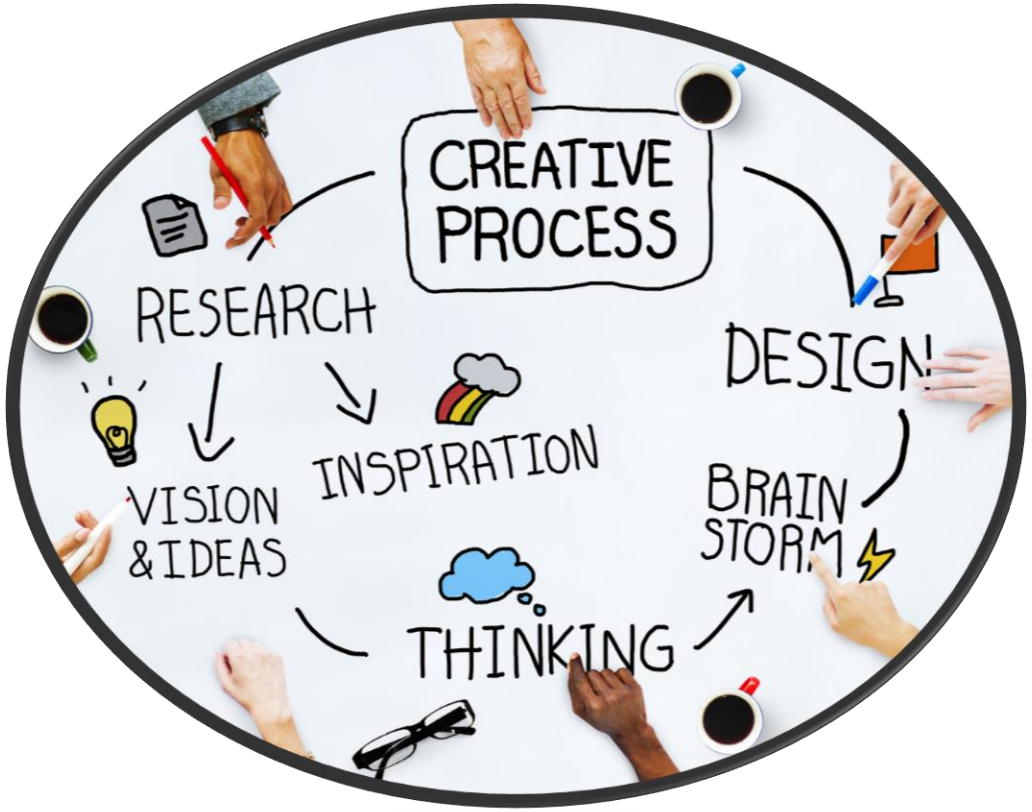
Alignment of Some GenAI Possibilities with Gifted Characteristics

Some Gifted and Twice-/Multi-Exceptional Learner Characteristics	GenAI Applications That Align
Advanced pattern recognition and abstract reasoning	Supports **complex problem-solving and visualisation of abstract concepts** through multimodal outputs
Asynchronous development (e.g., advanced reasoning but slow processing)	Provides **patient, non-judgmental interaction**; allows for **self-paced engagement** with information
Highly developed creativity and divergent thinking	Generates **expansive, novel ideas in response to open-ended prompts**; stimulates creative exploration
Executive function challenges (e.g., organisation, task initiation)	Assists with **structuring ideas, outlining tasks, and chunking information** into manageable steps
Strengths in visual-spatial over verbal domains	Creates **diagrams, visual metaphors, and structured visuals** to scaffold understanding
Perfectionism and high sensitivity	Provides a **low-risk environment for iterative drafting and experimentation** without social judgement
Difficulty with handwriting, reading, or decoding text	Offers **text-to-speech, summarisation, and scaffolded output to reduce cognitive load**
Deep curiosity and desire for personalised inquiry	Acts as a **responsive thought partner**—adaptable to learners' evolving questions and interests
Difficulty with sustained attention or working memory	Maintains **history of interaction**; recalls prior prompts to support continuity in thinking
Limited access to tailored extension activities in school	Produces **differentiated tasks**, challenge questions, enrichment and extension materials on demand

Rethinking Possibilities in Gifted Education and Talent Development…

- Constraints can inspire innovation
- GenAI is not *the* answer—but **part of the toolbox**
- From hammer to Zephyr, we've travelled through constraint, curiosity, and development
- If gifted learners are to thrive, not just survive their educational journeys –need to offer and support use of GenAI models and beyond…
- Into **the as yet unknown unknowns**…



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GenAI as a Cognitive Partner

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For Teachers:

- Modeling complex thinking processes
- Generating differentiated resources
- Supporting creative problem-solving approaches
- Creating opportunities for depth and complexity

For Gifted Students:

- Enhances divergent thinking
- Strengthens analytical capabilities
- Develops metacognitive awareness
- Supports self-directed exploration at their pace

Particularly valuable for twice-exceptional learners:

- Provides scaffolding while maintaining cognitive challenge
- Offers patient, non-judgmental interaction
- Accommodates different communication approaches

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Speculative Futures from the Edge of Possibilities…

Futuristic Possibility	Uncharted Function for Teachers of Gifted Learners	Prompt / Use Case Idea
Cognitive Multiverse Simulator	Model parallel pathways of a student's thinking—explores "what if…" in real-time	"Show me how Y might solve this problem through 3 entirely different frames of thought."
Inspiration Resonance Engine	Detects shifts in creative energy, proposing provocations or cognitive nudges at peak "flow" moments	"If my student is peaking in engagement, suggest a next-level provocation right now."
Socratic Echo Chamber Buster	Identifies when thinking has plateaued or looped in comfort zone; disrupts it with **"elegant intellectual friction"**	"Give me a high-level, unexpected counterpoint to this student's idea that will spark doubt."
Talented Time Capsule Curator	Captures snapshots of a learner's evolving talent to be unlocked months or years later for self-discovery and reflection	"Create a 6-month and 5-year letter from this student's future self based on today's work."
Neurodivergent Reality Designer	Co-builds alternative realities or speculative futures that reflect neurodivergent ways of knowing and being—not just accessibility	"Help design a school built entirely by and for sensory-seeking pattern thinkers."
Hidden Synapse Mapper	Detects invisible strengths or subconscious connections between disciplines within a learner's output	"What's the hidden conceptual link between this student's music and their physics theories?"
Ethical Entanglement Oracle	Constructs layered ethical dilemmas entangled with identity, technology, and possibility to deepen moral reasoning	"Create an ethical simulation where AI can enhance human life—but only for a chosen few."
Soulcraft Dialogue Companion	Facilitates philosophical inquiry rooted in the student's lived experience—mirrors back the ***why*** beneath their curiosity	"Help me mentor a gifted student exploring life, meaning, and purpose through their poetry."
Speculative Biography Generator	Projects fictionalised futures of a student's possible selves based on current traits and trajectories—sparks identity exploration	"Write a story of who you might become as a visionary neurodivergent inventor in 2050."
Cosmic Sandbox Architect	Designs open-ended, unstructured environments where "rules" of reality are optional—perfect for radical creative inquiry	"Build a world where gravity, language, and ethics function entirely differently—let's explore it together."

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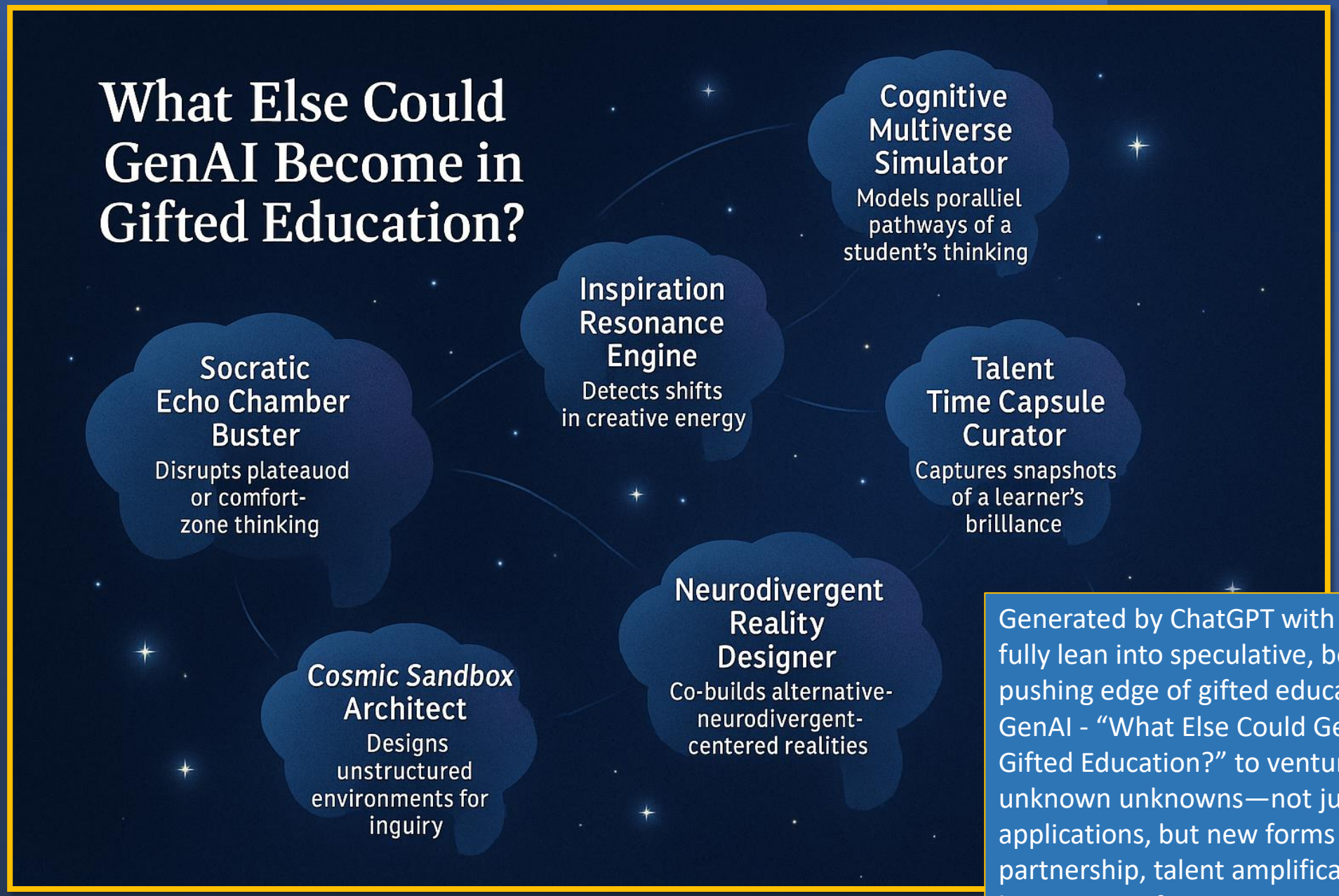

Generated by ChatGPT with prompt: "Let's fully lean into speculative, boundary-pushing edge of gifted education and GenAI - "What Else Could GenAI Become in Gifted Education?" to venture into the unknown unknowns—not just future applications, but new forms of pedagogical partnership, talent amplification, and learner transformation…

Future Directions??

- **Beyond Hammers and Nails…**
  - Move from formulaic prompts to creative exploration
  - I am interested in the, as yet, unknown unknowns…
- **For Teachers:**
  - Use GenAI to generate ideas, not replace expertise
  - Focus on thoughtfully crafted prompts
  - Guide students in harnessing GenAI responsibly
- **Researchers:**
  - More field testing with real educational applications
  - Development of structured prompt frameworks?
  - Exploration of GenAI for systematic talent development
  - Longitudinal studies on impact and outcomes

The real magic happens when we combine our expertise as educators/researchers with AI's capacity for generating novel connections and ideas..

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Research Participants Needed!
Do you know of a gifted teen using AI tools like ChatGPT outside school?

We're looking for gifted teens and their parents/caregivers to participate in an online interview about how teens use generative AI tools in creative and innovative ways outside school.

As a thank you, each teen participant with receive a $30 e-gift card!

The Research:

- **Conducted by Dr Michelle Ronksley-Pavia, Griffith University**
- **Explores how gifted teens use AI tools outside school**
- **Aims to better understand and support gifted students' learning with AI**

To Participate Your Teen Needs to:

- Be 12-19 years old
- Be identified as gifted via formal assessment
- Use any AI tools outside school
- Have parent/guardian permission

Interested? Email Dr Michelle Ronksley-Pavia at AIGiftedEducation@griffith.edu.au for more information

This research is funded by an American Psychological Foundation Esther Katz Rosen Fund Grant

Griffith University Ethics approval GU Ref No: 2024/915

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GRIFFITH UNIVERSITY

Research Participants Needed!
Do you know of a gifted teen using AI tools like ChatGPT outside school?

We're looking for gifted teens and their parents/caregivers to participate in an online interview about how teens use generative AI tools in creative and innovative ways outside school.

As a thank you, each teen participant with receive a $30 e-gift card!

The Research:

- Conducted by Dr Michelle Ronksley-Pavia, Griffith University
- Explores how gifted teens use AI tools outside school
- Aims to better understand and support gifted students' learning with AI

To Participate Your Teen Needs to:

- Be 12-19 years old
- Be identified as gifted via formal assessment
- Use any AI tools outside school
- Have parent/guardian permission

Interested? Email Dr Michelle Ronksley-Pavia at AIGiftedEducation@griffith.edu.au for more information

This research is funded by an American Psychological Foundation Esther Katz Rosen Fund Grant

Griffith University Ethics approval GU Ref No: 2024/915

Socratic Echo Chamber…Disrupting Plateaued Thinking/Comfort Zone with “Elegant Intellectual Friction”…

“Elegant intellectual friction” = a purposeful, thoughtful kind of cognitive tension that:

- **Challenges a learner’s assumptions**,
- **Stretches their thinking into new directions**, and
- **Invites them to wrestle with complexity**—but in a way that feels stimulating rather than threatening or frustrating.

In practice, this might look like:

- Presenting a gifted learner with a *counterintuitive question* that forces them to reconsider their position (e.g., “What if failure was a more reliable indicator of learning than success?”).
- Having a GenAI simulate a persuasive viewpoint that subtly *contradicts the learner’s own reasoning*, prompting deeper inquiry.
- Using irony, paradox, or subtle shifts in framing to *destabilise “certainty”*, nudging the learner to refine or expand their conceptual lens.

Why “elegant”?

Because it’s **precisely calibrated**—not aggressive, abrasive, or overwhelming. It’s a kind of ***intellectual jiu-jitsu***: a respectful, artful redirection of momentum that leads to growth.

- This aligns with gifted pedagogy – aiming to create disequilibrium for meaningful cognitive development—without slipping into chaos or disengagement.

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