

# Cognitive Architecture

rethinking thinking



## We provide support for **THINKING SCIENCE**


Thinking Science is a Cognitive Acceleration program for students in year 7 and year 8. Grounded in Piagetian and Vygotskian psychology, Thinking Science has been shown to dramatically improve learners' general thinking ability which in turn leads to improved educational outcomes. Support packages are tailored to your school's requirements.

 THE LESSONS



 TRAINING



 MICRO-COACHING



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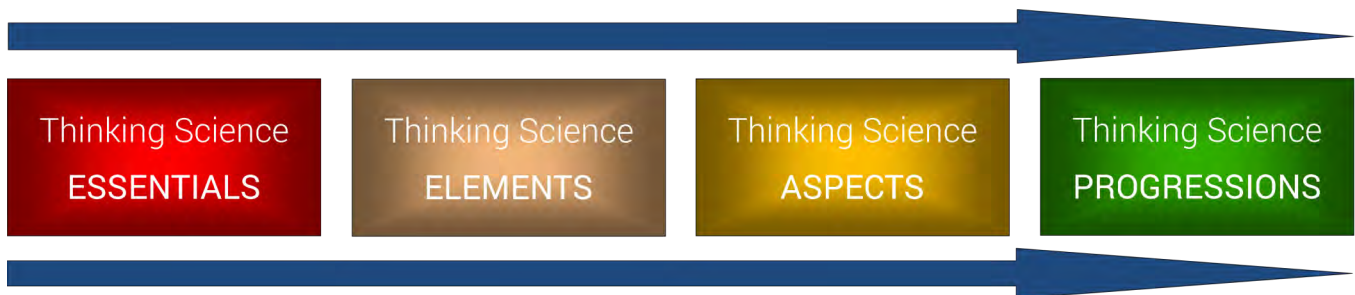


## Thinking Science Professional Learning Series

Thinking Science is a Cognitive Acceleration program that enhances student achievement in English, science and maths.

A significant evidence based professional learning program exists to support Thinking Science. Cognitive Architecture offers this program over two years. Find out how Cognitive Acceleration can:

- ◆ Promote critical thinking and problem solving skills
- ◆ Engage learners through effective group work
- ◆ Create life-long learners who can interact with the demands of the 21st Century



**ESSENTIALS** is a two day course.

It is the introduction to Thinking Science.

No prior experience of Thinking Science is required.

Completing **ESSENTIALS** with Cognitive Architecture leads to accreditation.

**ELEMENTS** is a one day course.

Ideally, participants will have taught lessons 1 – 5 of Thinking Science.

Participants usually complete **ELEMENTS** toward the middle of their first year of teaching Thinking Science

Completing **ELEMENTS** with Cognitive Architecture leads to accreditation.

**ASPECTS** is a two day course.

Ideally, participants will have taught the first year of Thinking Science.

Participants usually complete **ASPECTS** at the end of their first year of teaching Thinking Science.

Completing **ASPECTS** with Cognitive Architecture leads to accreditation.

**PROGRESSIONS** is a one day course.

Ideally, participants will have taught lessons 1 – 20 of Thinking Science.

Participants usually complete **PROGRESSIONS** towards the middle of their second year of teaching Thinking Science.

Completing **PROGRESSIONS** with Cognitive Architecture leads to accreditation.

# Thinking Science PL Series



**Tim Smith**

Tim is an international leader in science education. He has been working with Cognitive Acceleration since 2002 and he co-ordinates the Thinking Science network in Queensland.

During the professional learning series, Tim will guide you through explicit learning goals and ensure that you are equipped to facilitate highly effective learning experiences in your classes.

# Thinking Science Professional Learning Series

## ESSENTIALS Day 1

### Learning Goals



#### Session 1 – The Thinking Revolution

By the end of this session participants will be able to:

- relate to some of the topical tensions and dichotomies in Teaching and Learning today;
- visualise how Cognitive Acceleration programmes can inform planning for the Australian Curriculum;
- challenge their own thinking about how best to improve learner outcomes;
- question the notions of **academic resilience** (grit), **academic adaptability** (invent) and **academic joy** (love of learning).

#### Session 2 – What is Thinking Science?

By the end of this session participants will be able to:

- describe the Thinking Science programme and explain how it is underpinned by Piagetian and Vygotskian theory;
- differentiate Piaget's stages of cognitive development and know roughly when each occurs;
- identify the five pillars of Thinking Science as **Concrete Preparation, Cognitive Conflict, Social Construction, Metacognition** and **Bridging**;
- dissect Thinking Science lessons to show how the pillars give opportunity for cognitive acceleration;
- categorise Thinking Science lessons by their **schema** (or reasoning pattern).

#### Session 3 – The Science Reasoning Task

By the end of this session participants will be able to:

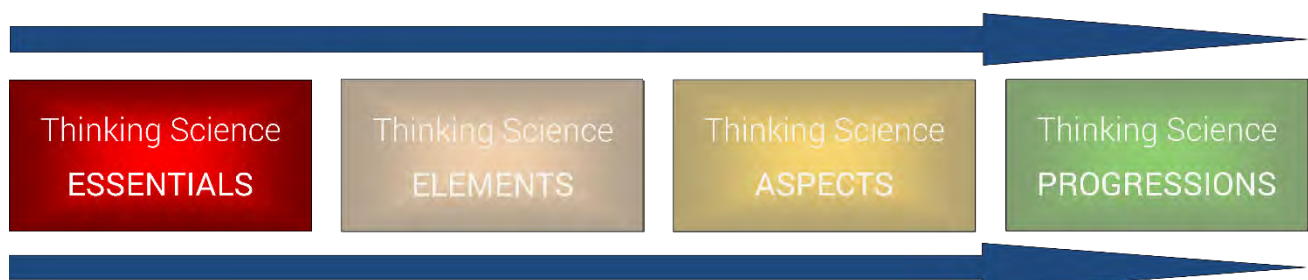
- apply and deliver the science reasoning task to judge thinking ability in their school;
- advise colleagues on the benefit of using the science reasoning task;
- analyse data obtained by the science reasoning task to assign groups that promote **social construction**.

#### Session 4 – A Thinking Science lesson – and a closer look at the schemata

By the end of this session participants will be able to:

- analyse the lesson plans and describe how **notesheets** and **workcards** can be used in lessons;
- deliver a lesson using cognitive acceleration techniques;
- synthesise the first two lessons of Thinking Science;
- integrate Thinking Science lessons into the general science curriculum.

Day one (50% of the **ESSENTIALS** course) should be delivered over 7 hours (incl. breaks). The balance of theory to practical on day one is about 60:40.



# Thinking Science Professional Learning Series

## ESSENTIALS Day 2

### Learning Goals



#### Session 1 – Going a little deeper: Cognitive Conflict

By the end of this session participants will be able to:

- describe how **cognitive conflict** plays a pivotal role in the Thinking Science lesson;
- identify, explain and give examples of **cognitive conflict**, reinvention in other lessons;
- examine the reasons behind the success of cognitive conflict in Thinking Science lessons.

#### Session 2 – Piaget's stages of cognitive development

By the end of this session participants will be able to:

- explain the Piagetian stages of development: **sensorimotor, pre-operational, concrete operational and formal operational** thinking;
- identify concrete operational and formal operational thinking;
- select teacher questions to bring about **metacognition**.

#### Session 3 – Challenges of Implementation

By the end of this session participants will be able to:

- think critically about the feasibility of running the Thinking Science program;
- advise colleagues on the benefit of running a Cognitive Acceleration program;
- present data and find the effect size of the program in your school;
- set up a coaching / peer support model to ensure Thinking Science runs smoothly during the initial phases.

#### Session 4 – The Thinking Science lessons (Lessons 1 – 7)

By the end of this session participants will be able to:

- analyse the lesson plans and describe how **notesheets** and **workcards** can be used in lessons;
- deliver a series of lessons using cognitive acceleration techniques;
- build metacognitive opportunities in lessons by applying Socratic questioning techniques;
- critically appraise colleagues' practice as a Cognitive Acceleration facilitator.

Day two (50% of the **ESSENTIALS** course) should be delivered over 7 hours (incl. breaks). The balance of theory to practical on day two is about 50:50. Completion of day one and two leads to **Thinking Science ESSENTIALS** accreditation.



# Thinking Science Professional Learning Series

## ELEMENTS (Day 3)

### Learning Goals



#### Session 1 – Thinking Science Pillars Revisited

By the end of this session participants will be able to:

- explain how each of the five pillars of Thinking Science fit into a lesson;
- analyse a lesson against the five pillars;
- define in simple terms the purpose of the five pillars in the context of Cognitive Acceleration;
- adapt lesson structures to accommodate the five pillars.

#### Session 2 – Identifying Cognitive Demand (Piaget’s Stages)

By the end of this session participants will be able to:

- differentiate between Piaget’s stages of cognitive development and know roughly when each occurs;
- describe thinking patterns in terms of Piagetian stages;
- make judgements using the Curriculum Analysis Taxonomies.

#### Session 3 – Formal Operational Thinking

By the end of this session participants will be able to:

- cite specific examples of formal thinking;
- assess questions in their ability to promote formal thinking;
- critique responses to metacognitive questions and show where formal thinking patterns are evident.

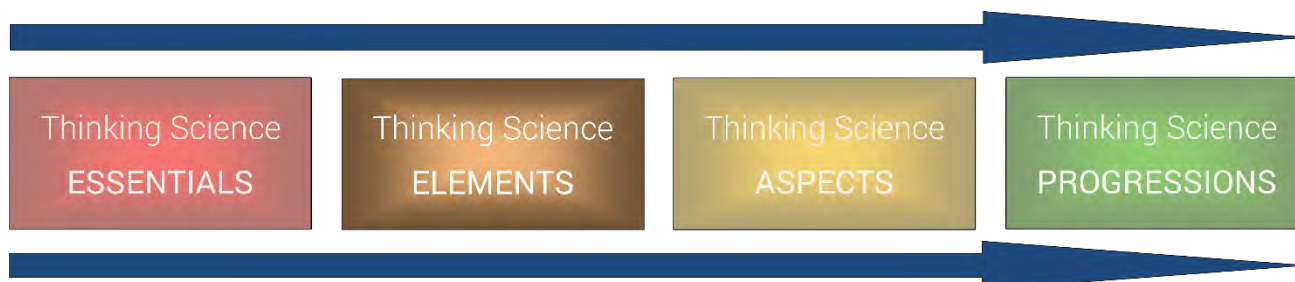
#### Session 4 – Getting a Handle on the Lessons

By the end of this session participants will be able to:

- deliver lessons 8 - 14 to bring about Cognitive Acceleration;
- advise colleagues on how to deliver year 1 of Thinking Science;
- recommend equipment and resources to colleagues and technicians.

**Thinking Science ELEMENTS** (day three in the Thinking Science Professional Learning series) is a one day (7 hours) course leading to accreditation once all eligibility criteria have been met. The balance of theory to practical in **ELEMENTS** is about 50:50 – significant opportunity for reflection on the first 7 lessons is provided; participants should have some experience of teaching Thinking Science lessons.

**Eligibility for Accreditation:** Thinking Science **ESSENTIALS** accredited, Delivered lessons 1 to 5 of the Thinking Science program at least once.



# Thinking Science Professional Learning Series ASPECTS (Day 4) Learning Goals



## Session 1 – Cognitive Acceleration, Piaget and the Australian Curriculum

By the end of this session participants will be able to:

- identify key concepts in secondary science and align them with cognitive demand;
- use collaborative learning as a way to develop Cognitive Acceleration techniques;
- define similarities and differences curriculum demands, teaching, and learning demands;
- articulate an argument for Cognitive Acceleration;
- refine judgements using the Curriculum Analysis Taxonomies.

## Session 2 – Metacognition: let me think about that...

By the end of this session participants will be able to:

- discern when metacognition is taking place in the classroom;
- use and critique lesson observation sheets;
- use questions and groups to bring about metacognition
- participate in lesson observations and part of a coaching process (**Micro-Coaching for Thinking Science** is encouraged during the second year of implementation).

## Session 3 – Big Data

By the end of this session participants will be able to:

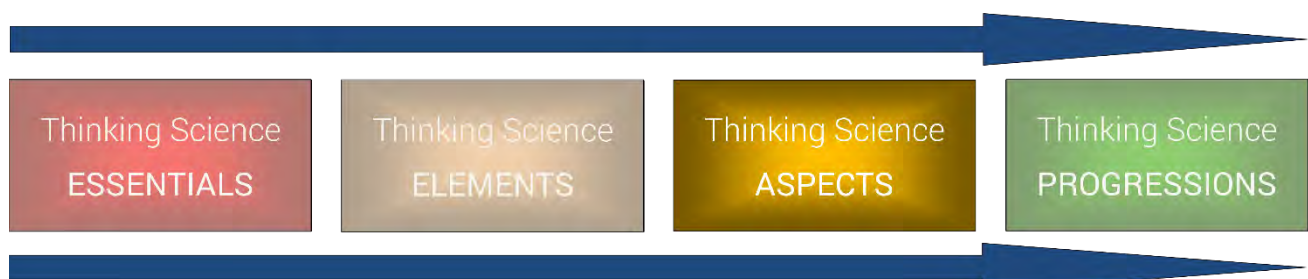
- cite reasons for the use of the Science Reasoning Tasks (SRTs);
- explain the parameters of each SRT and know how to draw useful information from the data;
- compare and contrast data from established tests (e.g. NAPLAN, Science Competition, GAT, PAT).

## Session 4 – Getting a Handle on the Lessons

By the end of this session participants will be able to:

- deliver lessons 15 - 20 to bring about Cognitive Acceleration;
- advise colleagues on how to deliver year 2 of Thinking Science;
- recommend equipment and resources to colleagues and technicians.

**Thinking Science ASPECTS** (days three and four in the Thinking Science Professional Learning series) is a two-day (14 hours) course. The balance of theory to practical in **ASPECTS** is about 60:40 – significant opportunity for reflection on the Piagetian school level data is provided; participants should have experienced the teaching of Thinking Science lessons 1 -14.



# Thinking Science Professional Learning Series

## ASPECTS (Day 5)

### Learning Goals



#### Session 1 – The PL Journey, Coaching and Lesson Observations

By the end of this session participants will be able to:

- comment on the effects of the PL program on practice;
- articulate goals, with associated SWOT analysis, of the coaching process;
- reflect on challenges, both practical and logistical, that the Thinking Science program presents;
- observe progress towards lead teacher criteria within the AITSL framework.

#### Session 2 – Overcoming the 'bridge too far'

By the end of this session participants will be able to:

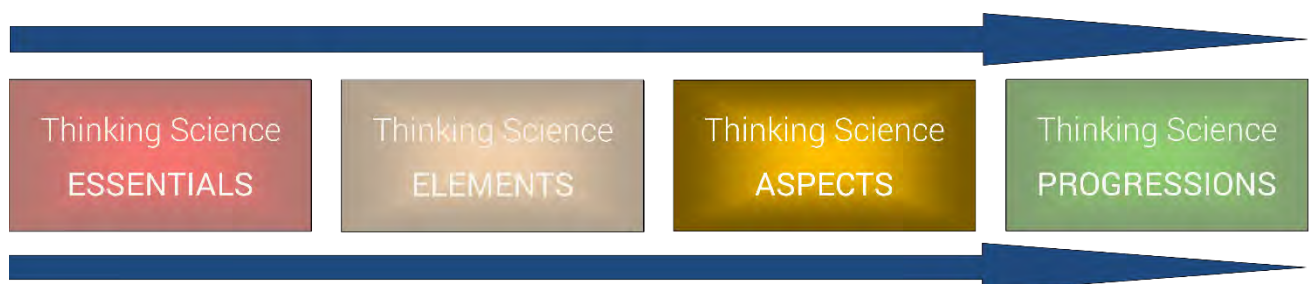
- identify how bridging can be used throughout a Thinking Science lesson;
- use a bridge to enable social construction and metacognition;
- see how an effective bridge can play a pivotal part in Cognitive Acceleration.

#### Session 3 – Lessons 21 to 30: a much closer look at formal operations in thinking

By the end of this session participants will be able to:

- deliver lessons 21 - 30 to bring about Cognitive Acceleration;
- team teach, critique and analyse Thinking Science lessons;
- recommend equipment and resources to colleagues and technicians.

**Thinking Science ASPECTS** (days three and four in the Thinking Science Professional Learning series) is a two day (14 hours) course. The balance of theory to practical in **ASPECTS** is about 60:40 – significant opportunity for reflection on the Piagetian school level data is provided; participants should have experienced the teaching of Thinking Science lessons 1 -14.



# Thinking Science Professional Learning Series PROGRESSIONS (Day 6) Learning Goals



## Session 1 – Building foundations: using the pillars everyday

By the end of this session participants will be able to:

- write lessons for any year using Cognitive Acceleration techniques;
- identify the pillars for a range of science lessons;
- problem solve, as a small group, issues around the teaching of 'thinking' within senior / junior science.

## Session 2 – Succession

By the end of this session participants will be able to:

- identify how the department, the school and local authority can embed Cognitive Acceleration and build a network for succession;
- plan for induction and renewal of staff who teach Thinking Science;
- establish links to national or regional strategies so that Thinking Science remains relevant to the curriculum.

## Session 3 – Self-audits for teachers of a 'thoughtful' classroom

By the end of this session participants will be able to:

- reflect on practice critically within the scope of Thinking Science;
- consider progress in key Cognitive Acceleration pedagogies: cognitive conflict, social construction and metacognition;
- articulate goals and plans for 'next-steps in PL'.

**Thinking Science PROGRESSIONS** (day six in the Thinking Science Professional Learning series) is a half-day (4 hours) course. **PROGRESSIONS** is predominantly theory and self-reflection; participants should have experienced the teaching of the whole Thinking Science program.

