# A Pedagogical Model for Improving Thinking About Learning

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*ABSTRACT: Gap To Got It Plus (GTGI+) Learning Thinking Stages© as a pedagogical model for teacher professional learning (TPL) across contexts is presented here to highlight the potential to improve thinking about learning for students and teachers. The Learning Thinking Scope© (LTS) programme is underpinned by the GTGI+ pedagogical model and four interrelated elements – Learning Clarity, Thinking Questions, Thinking Talk and Thinking Feedback. Here we unpack the pedagogical model and elements offered by the TPL programme that provide a coherent approach conducive for teachers to develop evidence-based strategies that are likely to result in learning improvement across a school. The LTS approach of efficacious teacher-led inquiry demonstrates that a multi-focused lens on learning should be soundly based on established principles from the formal and informal literature. The examples garnered from research across several contexts in New South Wales (NSW), Australia exhibit the crucial nature of using a model to develop practice protocols and school-wide routines. We consider the requirements of TPL for developing teacher thinking on their own and student learning and addressing any existing learning gaps. In highlighting the complexity required in TPL that enables continual modification of practice in context, we close by suggesting that continued cross case analysis is required to enable incremental improvements.*

## Introduction

Teacher professional learning (TPL) that focuses on thinking about learning in the classroom is reliant on the choices made from established taxonomies. A piecemeal approach for incorporating teacher development activities in a professional learning programme often presents an ad hoc use of taxonomies of learning. This article explores the framework of one TPL programme focused on developing thinking for students and their teachers. We examine the pedagogical underpinnings of efficacious teacher-led inquiry for developing coherent practices across contexts. Here we unpack the foundation for a TPL programme focused on a pedagogy of learning thinking. We explore how one TPL programme interweaves concepts to structure a

pedagogical model. The pedagogical language of the programme and the model accounts for the expected changes that can be observed as thinking progresses beyond the basic stages of learning demonstrated by recall of facts. The programme accounts for the struggles that teachers face in assisting students through more sophisticated levels of thinking and supporting the attendant stages of learning. Our discussion centres on the considerations necessary during the development of TPL, with our concluding thoughts addressing the need for TPL to apply practical protocols and routines necessary to improve thinking about learning and consistently apply these school-wide.

# Theoretical Foundations for Teacher Professional Learning

The theoretical foundations of TPL incorporate learning principles and approaches intended to change the professional practices, beliefs and understandings of teachers for improved student outcomes (Elbaz, 1983; Griffin, 1983). These continue to resonate across the research literature (Hattie, 2009, 2012; Loughran, 2010; Philpott & Oates, 2017; Timperley, 2011).

One sequential model for modifying teachers' beliefs and attitudes relies on observable improvements in student outcomes due to changed teacher classroom practice (Guskey, 2002). TPL may follow another sequence that increases skills and knowledge to initiate a change in beliefs and attitude, that in turn modifies teacher practice for improved student outcomes (Desimone, 2009). A more dynamic relationship between new learning and the teachers' professional environment (Clarke & Hollingsworth, 2002) describes non-sequential learning that occurs through multiple pathways and interactions that offer a variety of opportunities for teacher and learner. Additional complexity is apparent in a dynamic schema of learning (Opfer & Pedder, 2011) that identifies the interplay between the teacher (micro), the learning activity system (meso) and the school system (macro). This schema highlights the complexities of TPL that achieves school-wide improvement across contexts for learner growth. Overarching principles of effective TPL incorporate the coherence within context, the collective and active learning with colleagues, and applicability of content and duration of the learning (Desimone, 2009).

Tensions may become apparent when situating discrete professional development (PD) activities within a holistic view of personal professional learning for an evolving growth in expertise (Patterson, 2019). In some instances, TPL is seen to incorporate "job-embedded learning opportunities" of discrete development activities that form part of and without detracting from teachers' everyday efforts (Appova & Arbaugh, 2017, p. 13). Conspicuous considerations are the diverging personal needs and growth of teachers necessary to undertake TPL that may be limited through isolation, cost, or other professional constraints (Cameron et al., 2013). Whereas, focusing TPL on inquiry-based practices allows for leaders and teachers to share the responsibility of developing dialogic and collaborative practices derived within context (Kemmis et al., 2014). Therefore, it is important to frame TPL within and across different contexts to support "a more informed selection of theoretical models by researchers and practitioners" (Boylan et al., 2017, p. 120).

# The Learning Thinking Scope© (LTS)

This section outlines the schools participating to date in the research study and explores the features of the Gap to Got It Plus (GTGI+) Learning Thinking Stages© (Furney & English, 2016a) pedagogical model and The Learning Thinking Scope© (LTS) (Furney & English, 2016b) TPL programme.

## Researching Across Several School Contexts

Nine schools participating in the teacher professional learning programme since 2016 have contributed teacher reported data to an approved research study (ETH17-1191) through the University of Technology Sydney (UTS), Australia. Predominately from inner regional areas in the state of NSW, there were seven government primary schools and one government secondary college, and one metropolitan non-government secondary college. Details on the research methods and participating schools are discussed in another paper (Patterson & O'Brien, 2021). The examples and the TPL evaluations presented in this article represent diverse contexts to demonstrate how the programme enabled teaching teams to apply the pedagogical model. Teachers were able to share their collectively planned and assessed learning sequence and analyse the summary reports from their individually submitted evaluations of the workshops as discrete PD events.

## Teacher Collective Efficacy

The LTS is underpinned by a belief in the capacity of teacher collective efficacy to contribute to learning improvements (Paxon et al., 2014; Hattie, 2018). The design aimed to enable teachers to resolve the hardest challenges of their practice whilst building their individual and collective efficacy (Loughland & Nguyen, 2020; Paxon et al., 2014). As a pedagogy of learning focusing on thinking, the programme harnesses collective efficacy for developing teacher and learner thinking to improve outcomes school wide.

## Gap to Got It Plus (GTGI+) Learning Thinking Stages© – Pedagogical Model

The Learning Thinking Scope© was framed to develop teacher thinking for building practice protocols and school-wide routines in a pedagogy that focuses on learning thinking. The programme cultivates a language of learning through the pedagogical model named Gap to Got It Plus (GTGI+) Learning Thinking Stages© (Furney & English, 2016a). The circular model explores how to develop and extend thinking for learners and teaching teams through the four stages as outlined in Figure 1.

**Figure 1**

GTGI+ Learning Thinking Stages©
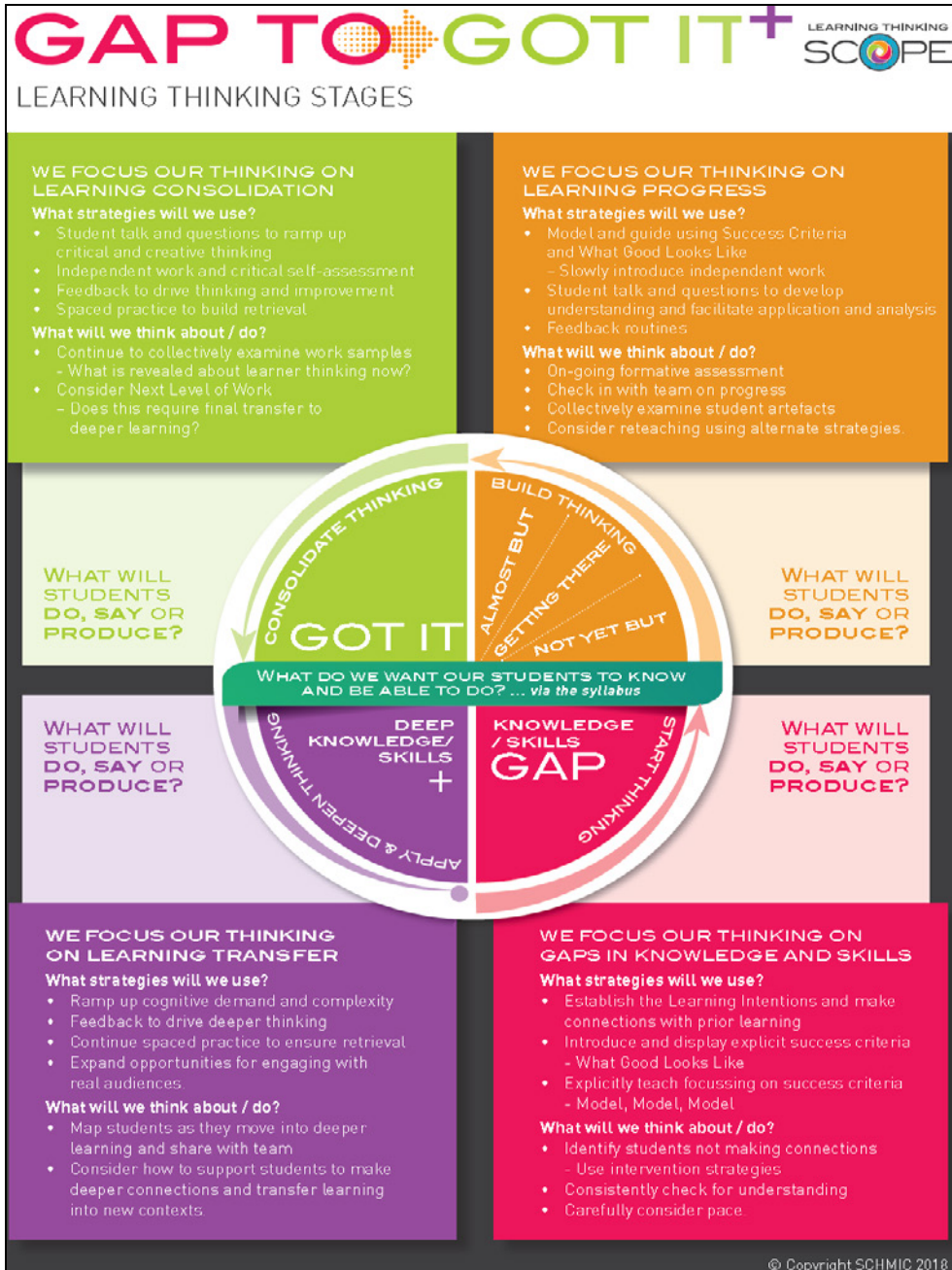


Reproduced with permission (Furney & English, 2016a, 2016b)

The pedagogical model provides a scaffold for teachers and learners to use. It focuses conversations for TPL on the learner's thinking moves through the stages of Gap To Got It Plus (GTGI⁺) and supports student reflection on their own progress. The model encourages teachers to collectively develop an agreed understanding of what 'good looks like' when they have Got It to achieve the learning outcome. Working from an agreed position, teachers then predict what they think learners will say, do, and produce through Gap, Not Yet But, Getting There, Almost But, Got It and Got It Plus. Teachers can collectively test strategies in their classroom to address their predictions, and then share findings to collegially determine the next level of work. Other models of TPL focus on various aspects that have been drawn together in The Learning Thinking Scope©. Notably, the use of a cycle of inquiry in a continuous spiralling process (Timperley et al., 2014), applying the instructional core as central to instructional rounds for TPL (City et al., 2009; Loughland & Nguyen, 2016) and the underlying importance of teacher collective efficacy for quality TPL resulting in shared change to practice (Loughland & Nguyen, 2020).

## Teacher-Led Inquiry

The Learning Thinking Scope© is structured as whole school workshops and coaching sessions of teams through teacher-led inquiry into practice over a minimum three-year implementation. The Introduction workshop overviews the GTGI⁺ pedagogical model used across the four core elements of the TPL. For the first element, Learning Clarity, teachers develop their thinking and practices with identified learning intentions and explicitly stated success criteria (Hattie, 2012; Ontario Ministry of Education - Student Achievement Division, 2015). The second element focuses on Thinking Questions, where teachers investigate the questions they pose and how they can enable learners to be better at asking questions themselves (G. I. Hannel & Hannel, 2005; Hattie 2009; Hattie & Yates, 2014). In the third element of Thinking Talk, teachers grapple with how to move from simple recitation and response or monologue as inculcated practice of talk in the classroom to extended dialogue and ultimately academic discourse (West, 2015, 2016). For Thinking Feedback as the fourth element, teachers examine how to provide formative feedback (Wiliam, 2011; Clarke, 2016) that is timely and effective prior to summative assessment tasks and before the timeframe for improving performance has passed (Black & Wiliam, 2010; Education Scotland, 2015; Hattie & Timperley, 2007). The Learning Thinking Scope© applies the GTGI⁺ pedagogical model across these four interrelated elements, explored in the section below, to create a cohesive approach across contexts as evidenced in the nine participating schools for this study, as indicative of TPL implemented effectively across systems (Labone & Long, 2016).

# GTGI⁺ Learning Thinking Stages© Across The Learning Thinking Scope©

The Learning Thinking Scope© enables teachers to continually modify practice with a shared pedagogical language and the GTGI⁺ Learning Thinking Stages©. Examples of the GTGI⁺ stages are explored below for each of the four elements: Learning Clarity, Thinking Questions, Thinking Talk and Thinking Feedback, and then followed by a sample for planning a lesson

sequence. Finally, a synopsis of the professional development evaluations conducted across the nine participating schools is presented.

## Learning Clarity

As the first element of The Learning Thinking Scope©, Learning Clarity requires teachers to collectively agree on shared definitions of learning intentions (LI), explicit success criteria (SC), big questions that engage learners in the curriculum and the Got It level for worked examples. Teachers are challenged to consider how these aspects of Learning Clarity should be used to drive learner thinking. The LI developed from the syllabus are used to create big or essential questions (Small, 2010; Wiggins & McTighe, 2012) that drive student metacognition and motivation. Teachers implement the LI and SC through practical strategies investigated collaboratively. Teacher clarity where formative assessment underpins practice is identified as having a high impact on learners successfully understanding LI and SC (Hattie, 2018). Learner-friendly language (Didau, 2014; Wiggins & McTighe, 2012) is essential for students' cohesive understanding across units of work rather than creating a disparate perception of their learning as ad hoc exercises or tasks (Black & Wiliam, 2010). Essential for student self-assessment is understanding the main purpose of their learning. Students need to be clear about what learning they are meant to attain and how their work will be judged, and teachers need to identify learning achievement through formative assessment. Evaluations are held regularly at teaching team level and at whole school level to assess progress and effectiveness of the whole school approach. Table 1 demonstrates an example developed by a teaching team in which Learning Clarity is used.

## Thinking Questions

Thinking Questions as the second element of The Learning Thinking Scope© asks teachers to consider the appropriate level of questioning that models high expectations, equity, and trust. Questioning is a mainstay of every teacher's daily repertoire and represents a significant amount of lesson time (Finley, 2014). However, asking simple questions only to elicit the correct answer from a student or to "guess what's in the teacher's head" (West, 2014, 03:58) is ignoring the power of developing a student's questioning capabilities. Thinking Questions starts by teachers collectively developing a shared understanding of what quality questioning looks, sounds, and feels like in the classroom for both teachers and students.

**Table 1**

GTGI+ Learning Thinking Stages© For Learning Clarity

| GTGI⁺ Learning Thinking Stage | Teaching Team Example |
|---|---|
| Start Thinking<br><br>• Collectively develop LI and SC, and 3 to 5 big questions.<br>• Investigate LI and SC with students.<br>• Deconstruct explicit SC.<br>• Introduce 3-5 big questions. | Year 7 Digital Technology – Gap: reduce 'learned helplessness' to promote individual thinking first.<br><br>LI: I can use logical reasoning to recognise and correct errors.<br><br>SC: Correct simple errors in a block of code (debug) to produce and run a simple program. Evidence will be all errors bound in a code sheet (debugged).<br><br>Big Qu's: Why do I need to code? Why is computational thinking useful for everyone? Why don't we usually see images of female programmers? |
| Build Thinking<br><br>• Check the LI and SC are clear, revisit often.<br>• Use the big questions.<br>• Student self-assessment based on SC. | Use willingness and risk-taking approach to coding for approach to detailed correction of inaccuracies in spelling.<br><br>Assigned groups are given a block of code which they will 'bug' with 10 errors. Collaborate on strategies and skills, using online resources. Identify and amend errors to demonstrate a working programme. |
| Consolidate Thinking<br><br>• Revisit the big questions.<br>• Revisit LI.<br>• Student self-assessment based on SC. | Share the logical reasoning used by groups to create a list of correct spelling to use and errors to be avoided<br><br>Identify and amend errors in an unseen block of code to demonstrate a working programme as a group, and then individually. |
| Apply and Deepen Thinking<br><br>• Apply SC to new contexts. | Provide examples for students to apply SC to a new context.<br><br>Apply student's willingness and risk-taking approach to coding to an increased level of difficult programmes that are selected by the student. |

Questioning should generate thinking that moves students through the GTGI⁺ stages. Ideally, teachers collaborate on the nature of questions used in each learning sequence or unit of work and look for answers and work samples that demonstrate progress in thinking skills. Teachers investigate strategies for developing the use of dialogue to improve the quality of learner questions (Davies et al., 2017). Teachers also collaboratively develop metacognitive thinking tools that are regularly collated and analysed. Teacher questioning encourages students to reflect on their own level of thinking and how this is leading them towards achieving the LI

and SC. Responses of students are integral to guide formative assessment. Student responses can display the gap between the content and the student as well as the gap between the teacher and the student (I. Hannel, 2003). Classroom routines that make the explicit connection between student thinking and learning progression are collectively designed, tested, and refined. The routines can be verbal, non-verbal, involve written reflections or simple graphic organisers. Teachers collaborate in teams when analysing work samples, look for patterns of practice and critically analyse their questioning and that of their students. The teacher-led inquiry includes an evaluation for teachers to reflect on their changed practice and coaching to provide essential feedback for teachers as they develop their pedagogy. Teacher planning of their questions and student use of tools to promote Thinking Questions for each GTGI[+] stage are shown in Table 2.

**Table 2**

GTGI+ Learning Thinking Stages© for Thinking Questions

| GTGI[+] Learning Thinking Stage | Teaching Team Example |
| --- | --- |
| Start Thinking<br><br>• Help students to understand the LI and SC of the learning.<br>• Connect students to prior learning.<br>• Check for understanding gaps in their thinking. | Year 8 English – Gap: Little use of drafting results in a lengthy analysis rather than a succinct thesis statement.<br><br>LI: I can write a concise and effective thesis statement.<br><br>SC: Form a thesis statement verbally and in writing for a selected poetry anthology.<br><br>Big Qu's: Can I express an opinion that is debatable and can be argues? How do I persuade people that my opinion is valid? How do I identify a contentious thesis statement? |
| Build Thinking<br><br>• Help students to find key details and new language.<br>• Allow exploration of purpose, student connections and audience identification.<br>• Check for emerging understanding. | A definition and examples of 'what good looks like' for a thesis statement is agreed by teachers, and their understanding of 'learner language' is shared with students.<br><br>Assigned groups are given a list of claims (good and not so good) thesis statements to evaluate by identifying the limitations of first responses, mistaking passion for logic, and no editing or redrafting.<br><br>Use Thinking Question tools i.e., Blooms Taxonomy of Qu's, Higher order sentence stems, Critical and creative thinking framework, to question each other about the examples. |
| Consolidate Thinking<br><br>• Provide opportunity for making inference.<br>• Identify increasingly complex connections. | Collaborate on definition and good examples of a fact, a definition, and an opinion, using models from known texts.<br><br>Write individual thesis statements. Use Thinking Question tools for paired peer evaluation.<br><br>Annotate first draft of thesis statement with feedback. |

| GTGI⁺ Learning Thinking Stage | Teaching Team Example |
|---|---|
| • Check for consolidated understanding. | Repeat peer evaluation with another peer for second draft. |
| | Read thesis statement to class to identify fact, definition, opinion. Discuss how questioning of verbal evidence influenced the draft writing and final product. |
| Apply and Deepen Thinking | Select a contentious thesis statement – from a peer or elsewhere – to create questions for discussion. |
| • Motivate students to determine and justify their own position on issue or ideas with appropriate evidence. | Collaboratively evaluate different approaches to writing a statement e.g., composer's message and audience's response. |
| • Check for application and deep understanding. | |
| • Ask for students to apply their learning to a new situation. | |

## Thinking Talk

Thinking Talk as the third element of The Learning Thinking Scope© explores how types of talk can be employed to improve students' depth of thinking about their learning. Drawing on the power of teacher collective efficacy, teachers agree on a shared definition of what Thinking Talk will sound, look, and feel like in classrooms across the school. Teachers work in teams to develop exemplars of practice and techniques to promote rich talk in the classroom with the use of academic discourse as the most advanced level of talk for developing student critical thinking (Alexander, 2008). Teacher-led inquiry focuses on co-constructing knowledge, considering big questions to stimulate talk, developing practical examples, and assessing the effectiveness of dialogue and academic discourse in their classroom.

The GTGI⁺ Learning Thinking Stages© provide a scaffold to encourage metacognition in peer dialogue that is important for collaborative talk (Newman, 2016) and allows teachers to investigate different types of talk and their purpose for teacher and learner. Ongoing dialogue between teachers and students provides the opportunity for students to overcome misconceptions, construct knowledge and develop critical thinking (Davies et al., 2017). Teaching teams evaluate their progress and their effectiveness in questioning in the classroom and in written tasks. Improving the quality of dialogue and the participation levels of their students in discussions as students move through Learning Thinking Stages are evidenced in a noticeable change in the way students use talk in each lesson. Table 3 illustrates one teaching team example of using GTGI⁺ stages for Thinking Talk.

**Table 3**

GTGI+ Learning Thinking Stages© for Thinking Talk

| GTGI⁺ Learning Thinking Stage | Teaching Team Example |
|---|---|
| Start Thinking<br><br>• Primarily exposition on the gap to introduce the new topic or idea, stating LI and SC, using whole class structures.<br>• Students talk mostly to clarify questions and language or retelling with alternatives from their understanding. | Stages 5 and 6 Languages – Gap: Writing in English first then creating literal translations with inaccuracies using online tools.<br><br>LI: I can articulate the reasons for my choice in language use e.g., verb endings..<br><br>SC: Produce authentic writing e.g., a recount, with annotated reasoning i.e., the strategies or examples used.<br><br>Big Qu's: What are the benefits of learning a language? How do we recognise authentic language? How do we produce writing that is authentic? How are understandings of a culture and its language related? |
| Build Thinking<br><br>• Small group discussions, turn and talk with partner routines, whole class discussions to expose opinions and ideas of others. | Assigned groups discuss an authentic text and identify aspects to use as a model for writing.<br><br>Assigned groups discuss a sample of writing structured with omissions and use the guidelines and scaffolds provided to complete the text together. |
| Consolidate Thinking<br><br>• Using partners or small group strategies to consolidate thinking through dialogue. Promoting dialogue and discussion for sharing reasons, justifications, and clarifications. | A definition and examples of authentic writing are co-created through group discussion.<br><br>Groups demonstrate the written text through role play for class to identify authentic connection between culture and use of language.<br><br>Class collates features and strategies used to write an authentic text. |
| Apply and Deepen Thinking<br><br>• Students expand their thinking through discourse on multiple levels.<br>• Students encouraged to engage in sophisticated meta-language and thought processes to evaluate and create new points of view. | Selection of various forms of text – written, sung, spoken in audio or video – for groups to evaluate through discussion.<br><br>Create a transcript to record an oral interview or multi-media presentation.<br><br>Peer assessment of the transcript with the recording to annotate aspects of authentic language use. |

## Thinking Feedback

Thinking Feedback as the fourth element of The Learning Thinking Scope© guides teachers to explore the varied forms of feedback needed to support their students to think more deeply about their learning. Effective feedback requires distinct levels pertaining to the task, process, self-regulation and self-evaluation (Hattie & Timperley, 2007). The Learning Thinking Scope© offers strategies for feedback on learning to indicate where and how the learner is progressing (Fisher & Frey, 2009) and therefore supports students to refine, expand upon, reframe, and improve their work. Thinking Feedback also reinforces the commitment towards collective efficacy as teachers are asked to collaborate in the development of a feedback system for their school. As feedback exerts a strong influence on student learning achievement with a high positive impact (Hattie, 2018), teachers develop feedback strategies in teams, measuring and evaluating their impact. Thinking Feedback, as the final element, anchors student involvement in the LI and SC, the questions asked and the emerging dialogue extending to academic discourse. Effective feedback is considered at each GTGI+ stage and how best to stimulate thinking from simple concepts to higher order thinking. Table 4 illustrates how GTGI+ Learning Thinking Stages© for Thinking Feedback are integrated on multiple levels – for the learner in self-assessment, and between students with peer-assessment, and formative and summative teacher assessment.

**Table 4**

GTGI+ Learning Thinking Stages© for Thinking Feedback

| GTGI+ Learning Thinking Stage | Teaching Team Example |
|---|---|
| Start Thinking <br><br> • Feedback on learning clarity is mostly descriptive. | Stage 4 Maths – Gap: not using corrections on homework or exams to identify mistakes and reflect on understanding. <br><br> LI: I can avoid continually making the same error by noting the corrections I need to practice. <br><br> SC: Produce self-corrected work, write corrections in a different colour next to the incorrect answer, re-attempt a similar question. |
| Build Thinking <br><br> • Feedback on progress is instructional focus with LI. | Similar correction notations are agreed by teachers and shared with students. Use examples from student workbooks showing correctios at three levels 1) Got it, 2) Getting there or Almost but, and 3) Not there yet. Discuss what is not helpful, what is helpful in the good exemplar, why and how to use the agreed correction notations. Annotate the Stage 4 class mark tool that contains criteria for self-correction. |
| Consolidate Thinking <br><br> • Feedback on performance is explicit on SC. | Use a timer to complete questions and correct and use Stop Light (Green, Orange, Red) to check understanding. <br><br> Repeat out of class with homework or exam questions. |

| GTGI[+] Learning Thinking Stage | Teaching Team Example |
|---|---|
| Apply and Deepen Thinking<br><br>• Feedback on deeper learning draws on peer and teacher assessment. | Peer assessment of self-corrected work to identify the understanding that has been checked and corrected. Use the Stage 4 class mark tool with the criteria for self-correction.<br><br>Discuss real-world example of: how is learning unpacked? Why is it important to keep asking why? |

## Planning a Learning Sequence

Planning a learning sequence using the model requires teachers to focus on student thinking and how to encourage a progression in thinking skills. The sample (see Table 5) for an Introduction to Microscopy is drawn from the Stage 4 Science curriculum provided by the NSW Education Standards Authority (NESA, 2018). A teaching team unpacked the learning of a new skill and accompanying background knowledge from the viewpoint of the teacher and the student. The teacher-led inquiry predicted interactions for teacher and student as shown in Table 5.

**Table 5**

GTGI+ Learning Thinking Stages© For Planning A Learning Sequence

| Teacher Interactions | Student Interactions |
|---|---|
| Start Thinking<br><br>• Introduce the required vocabulary, 2D and 3D diagrams.<br><br>• Deconstruct the microscope to show working parts (exposition).<br><br>• First big question, whole class discussion e.g., Why would scientists need a microscope?<br><br>• Directed questions following brainstorming by students about the first big question.<br><br>• Revisit Learning Intentions e.g., I am learning to use a microscope and state the functions of the parts of a microscope. | Start Thinking<br><br>• Express thinking on the new words and diagrams.<br><br>• Asking questions to help understand new terms and images.<br><br>• Brainstorming with peers and class group on the first big question.<br><br>• Deconstruct the microscope to show working parts.<br><br>• Suggest answers to the first big question.<br><br>• Create statements on explicit SC in the first person of – I can: Label a diagram of a microscope and state the function of each part; Prepare a microscope so I can view a specimen; Prepare a microscope slide with a specimen (slide mount); View a slide through the microscope; and Draw labelled diagram of what I see and record accurate detailed notes of my observations. |
| Build Thinking<br><br>• Ask the second big question e.g., Why does the light source need to be the best | Build Thinking<br><br>• Begin using specific new words when discussing procedures in their small group. |

| Teacher Interactions | Student Interactions |
|---|---|
| I can provide? How would I prepare the specimen for viewing?<br><br>• Present best practice procedure.<br><br>• Questioning on mounting a slide.<br><br>• Engage in dialogue about any difficulties they are experiencing (individual/small group). | • Trial and error with the light source, think about how it should be arranged.<br><br>• Ask questions about the best set up for slide and light source.<br><br>• Dialogue with partner or group when thinking about the best method for preparing specimens.<br><br>• Feedback to the teacher about the level of difficulty. |
| **Consolidate Thinking**<br><br>• Revisit Learning Intentions, review of student work.<br>• Assessment of the theoretical and practical aspects based on the success criteria.<br>• Revisit first two big questions.<br>• Feedback on performance. | **Consolidate Thinking**<br><br>• Display mastery of new vocabulary.<br>• Document achievement of the Learning Intentions.<br>• Clearly explain how they have achieved success criteria, provide evidence.<br>• Be able to answer the first two big questions. |
| **Apply and Deepen Thinking**<br><br>• Ask the third big question e.g., What would I like to see most through the microscope?<br><br>• Engage class in discussion and small groups or individuals in dialogue related to the three big questions.<br><br>• Assist students with more advanced techniques as required.<br><br>• Feedback on deeper learning. | **Apply and Deepen Thinking**<br><br>• Use new skills to confidently set up required equipment.<br><br>• Engage in dialogue about the three big questions.<br><br>• Conduct an independent investigation into novel slide preparations and accurately document the process. |

## Professional Development (PD) Evaluations Across Nine Schools

After the completion of each workshop in the TPL programme, teachers evaluated the programme as registered Professional Development (PD) through the NSW Education Standards Authority (NESA, 2019). As of October 2019, approximately 80 per cent of teachers across the nine schools had completed evaluations on the workshops for Introduction, Learning Clarity, Thinking Questions and Thinking Talk. Teachers responded on a 5-point Likert scale to three areas identified in Table 6 that provides the number of evaluations completed and the average scores.

**Table 6**

Summary of PD Evaluations

| PD Evaluation | Learning Clarity | Thinking Questions | Thinking Talk |
|---|---|---|---|
| Total completed | 101 | 200 | 113 |
| Descriptor/s addressed by the course (Average /5) | 4.3 | 4.1 | 4.2 |
| Gained useful knowledge, skills and understanding (Average /5) | 4.1 | 4 | 4 |
| Materials and strategies used were appropriate and useful (Average /5) | 4.1 | 4 | 4 |
| Percentage of teachers putting learning into practice | 91% | 81% | 84% |

Of significance, are the consistently positive responses by teachers about their learning. Asked for a definitive Yes or No response, 80 per cent of teachers indicated that they had attempted to put their learning into practice. An optional response allowed teachers to explain ways they had enacted a change to their practice, with examples shown below.

Learning Clarity – Students have responded well when the 'learning intentions' have been identified and discussed for clarification. Students have access to examples of the expected outcomes of their learning, which give clear direction and boosts confidence.

Thinking Questions – I think more carefully about the type of questions I ask of my class and the position of these questions in the programme. Implement a 'wait-time' strategy as part of classroom routine to allow students think time before answering questions.

Thinking Talk – Students are so much more engaged in their learning and participate in so much more thinking talk with each other and within classroom discussions and group activities.

These sample responses were indicative of the predominantly positive impact of the programme, with further discussion of teacher generated data on their inquiry-led practice presented in another paper (Patterson & O'Brien, 2021). Many responses indicated that teachers were still working towards integrating the wealth of strategies offered by The Learning Thinking Scope©. This is indicative of the time and efforts required by teachers to continually explore the evidence-basis of the informal and formal research literature to deepen their understanding of learning about thinking and application to practice, and to develop as leaders of their own learning in collectively efficacious efforts with their colleagues (Paxon et al., 2014; Poekert, 2012).

# Conclusion

This article highlights the need for TPL to use multi-focused learning lenses that develop complex learner thinking and teacher-led inquiry to modify practice. We have explored The Learning Thinking Scope[©] as one Australian example of TPL to consider what pedagogical underpinnings produce efficacious teacher-led inquiry with coherent practices across contexts. The pedagogical language of the GTGI[+] model provides a scaffold for collective thinking of teaching teams. Teachers worked in curriculum Stage or Learning area teams to devise the LI and SC, big questions as well as strategies for questioning, talk and feedback for improving student outcomes school-wide.

The Learning Thinking Scope[©] as implemented across nine NSW schools captured teacher generated data to evaluate the effectiveness of the TPL (Patterson & O'Brien, 2021). Professional development that targets one aspect of practice may allow for reflection but not result in change in practice (Edmondson & Choudhry, 2018) as demonstrated with the integration of the model throughout the longitudinal timeframe of the programme. The GTGI[+] pedagogical model aimed to assist teachers and students to understand the development of critical thinking in learning. As students acquire new knowledge and skills, they can recognise their progression and map their achievements in the GTGI[+] Learning Thinking Stages[©]. The cycle encapsulated thinking for identifying the gap in knowledge and skills, through building and consolidating thinking in new learning, to the challenges associated with applying deeper thinking to critical and creative problem solving. The GTGI[+] pedagogical model also provided a framework for teachers to support the development of thinking across the four elements of Learning Clarity, Thinking Questions, Thinking Talk and Thinking Feedback in The Learning Thinking Scope[©].

The teacher-led inquiry of The Learning Thinking Scope[©] requires TPL leaders to model and advocate an agreed and shared pedagogical approach school wide. Mentoring TPL leaders requires developing their coaching capabilities to apply practice protocols and support teams in teacher-led inquiry that analyses the data from investigations into practice (Earl & Timperley, 2009; Timperley, 2015). Successive inquiry cycles require TPL leaders to coach teachers in identifying and exploring a problem of practice to propose a theory of action for trialling relevant strategies (City, 2012; City et al., 2009) that encourage differentiation for learners (Tomlinson 2014; Tomlinson & Murphy, 2015). Agreed use of practice protocols focuses on teacher expectations and their predictions of what learners can do, say, and produce, as well as deciding on the evidence to determine the impact on student thinking. Video examples are used to analyse ideas and strategies from international classroom practice (EL Education, 2015; Teaching Channel, 2019) and how to apply, deepen and analyse the thinking of their learners. Therefore, it is integral to teachers that their TPL leaders encourage investigation of new strategies across teaching teams for development into school-wide routines.

The Learning Thinking Scope[©] relies on the significance of the underpinning philosophy of collective efficacy to drive change in school culture. The TPL supports leaders to enable adoption of emerging school-wide routines into changed practice for all. Special consideration is needed by the school leadership to consistently support the development of teachers and TPL

leaders (Poekert, 2012) as they develop the central concepts of the GTGI⁺ Learning Thinking Stages© pedagogical model within the school context. The programme draws on the evidence-basis of the formal and informal literature, acknowledging the subjectivity of teacher and student self-reported data in being transferrable rather than generalisable across contexts (Mansfield & Thompson, 2017). The focus of TPL needs to acknowledge the complexity required that cannot be measured by "quick gains in student achievement data" (Loughland & Nguyen, 2016, p. 515) but provides a model to centre teachers thinking on their own learning as well as that of their students.

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