Chapter 3:

How do we arrange?

Organise & Manage

Chapter 3
How Do We Arrange?

One of the most common questions is 'how do others use the MELT?' When turning to the MELT, educators want more than a philosophy; they are looking for a framework that can give tangible starting points for facilitating sophisticated learning. This chapter provides examples of the ways that others have arranged MELT, to inspire educators to adapt the MELT to diverse contexts. Inspiration is provided through the diversity of contexts and approaches, rather than a narrow range of age- or content-specific resources.

Specifically, in this chapter shows how educators have used their own adaptations of the MELT to benefit student learning, with examples and links applicable to early childhood, primary, secondary, technical education, undergraduate, course-based master's, and doctoral programmes. There are also examples that span across disciplinary learning and transdisciplinary projects, and those that are aligned to Direct Instruction or to discovery learning.

In terms of modelling the MELT facets, they maybe taught and learned in the sequence presented in Chap. 2. However, in reality, sophisticated learning is frequently non-sequential, messy and recursive. A linear, sequential approach can be used early-on with students in highly prescriptive activities, and in contexts where they have little experience: this is the case whether in primary, middle and secondary school, undergraduate, Master's and sometimes the early months of Ph.D. studies. Once students can begin to make some decisions and display autonomy in their learning, they will employ the facets non-sequentially.

The figures below are screenshots of resources available online that are presented not to read in themselves, but to refer to the associated weblink.

J. Willison, *The Models of Engaged Learning and Teaching*,
SpringerBriefs in Education, https://doi.org/10.1007/978-981-15-2683-1_3

3.1 MELT Connecting

MELT is applicable to many contexts. However, modifications necessary for MELT to work are needed for each context. Furthermore, how MELT should be implemented is determined by the specific contextual conditions. Only those individuals facilitating the learning have the requisite knowledge of the students, topics, desired learning outcomes and broader environment to make suitable professional judgements. For MELT to be effective, teacher engagement and autonomy are necessary.

To facilitate teacher engagement, experience and emerging evidence have demonstrated that the single most helpful factor for the successful adaptation and use of MELT is conversation. Through mature, inter-professional conversation, the MELT is defrosted and animated with the warmth of human interaction. These conversations may take place between colleagues, classroom teachers and coordinating academics, tutors at university, school and home, principals, librarians, learning advisors, and parents. Engagement, based around MELT, provides common ground and fosters discussions, collegial debate, disagreement, and ways to proceed. The most important conversations, however, are with and between students. A crucial pedagogical question is, 'when and to what extent should we make the MELT facets and the *continuum of autonomy* explicit so that students may metacognitively *follow, improvise* and *initiate*?'

3.2 Many Models Across Educational Levels and Contexts

For ease of access, the following sections are arranged according to educational levels. However, approaches used at one educational level maybe pertinent to other contexts. It is advisable to consider scanning several examples.

The approaches used are for:

- Early childhood—five-year-olds: song, rhythm and movement
- Year/Grade 4/5: problem-based learning pentagon for teacher planning
- Year/Grade 6: interactive introduction to investigation framework for direct student use in term-long projects, with issues chosen by students
- Year/Grade 7: interactive introduction to investigation framework for student direct use in guided transdisciplinary projects
- Year/Grade 8: interactive introduction to project-based learning pentagon for direct student use in an intensive three-week STEM project posed by an industry partner
- Year/Grade 9/10: interactive introduction to MELT for direct student use in three-term projects with issues chosen by students
- Technical and Further Education
- First year of university: interactive introduction to RSD and use across two consecutive terms; multiple assignments in terms of marking criteria and feedback
- Second year of university: Human Resource Management
- Honours year: Medical Science

- Master's year 1: interactive introduction to RSD and use across two consecutive assignments, in terms of marking criteria and feedback.
- Master's year 2: student self-assessment using RSD in the early phase of the major research project (one semester full-time)
- Doctoral studies: self and supervisor assessment of the proposal.

3.2.1 Early Childhood

Marsha Seebohm (a music specialist teacher at Elizabeth North Primary School in Adelaide) developed an exemplary tool for facilitating MELT in an early childhood education setting. In 2014, Marsha adapted MELT facets as lyrics to the tune of a widely-known folk song, 'She'll be coming 'round the mountain when she comes' so that it would be suitable for five-year-olds (Fig. 3.1).

Examples of children singing Research Mountain, and the actions associated with the song, performed by an adult audience are available on the MELT website. As a teaching tool, it is in keeping with the tenets of active, embodied learning which are so important in early childhood education contexts. Marsha developed the song to provide young students with a sung and performed heuristic for inquiry learning. She is exploring the song's use by teachers in their regular classes.

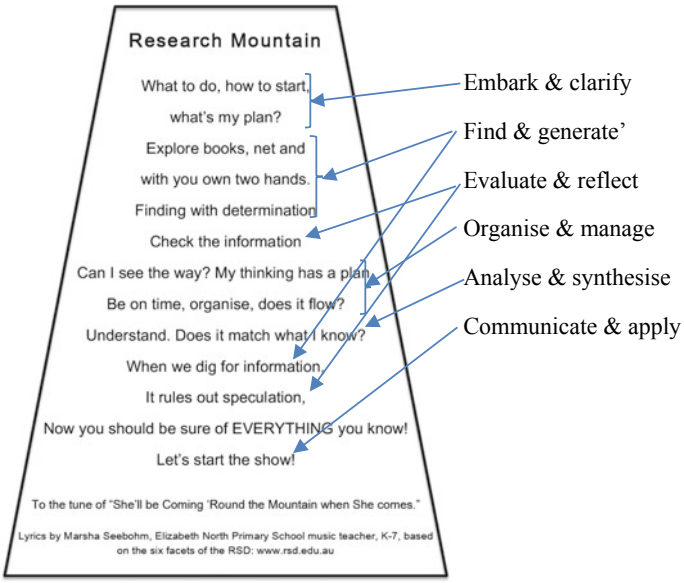


Fig. 3.1 Research mountain, a song for 5 year olds. https://www.adelaide.edu.au/melt/k-12-education#early-childhood

In addition to this example based on a folk song, another ECE version of MELT in action (based on a nursery rhyme) is on the website at www.melt.edu.au.

In this example, and some of the others below, there is no explicit mention of autonomy. Autonomy in these examples is an aspect for teachers who apply professional judgement in considering 'how much structure and guidance do these students need?' and whether to introduce ideas around autonomy or not.

3.2.2 Year 4/5 Primary

Year 4/5 teachers involved in a Science Technology Engineering and Maths (STEM) initiative at a government Primary School transformed the MELT into a Problem Solving Pentagon. The school had been introduced to an engineering design framework, the terminology of which was used to inform the Problem Solving Pentagon. The teachers used this for their own thinking about design in their lesson planning, but not explicitly to facilitate student learning. However, the motivation to develop the model was to facilitate student engagement in intentional learning in STEM (Fig. 3.2).

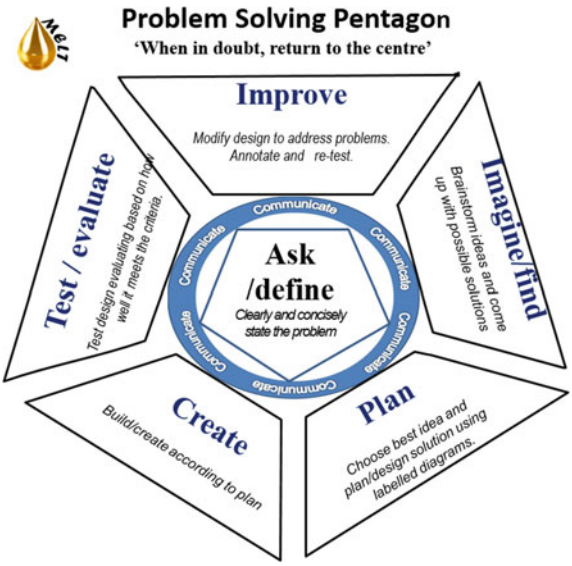


Fig. 3.2 Primary/elementary school problem-solving pentagon. www.adelaide.edu.au/melt/k-12-education#primary

3.2.3 Year 6 Primary School

The International Baccalaureate (IB) is a curriculum that is run in many countries, with separate but related primary years, middle years and diploma (senior years) programmes. The Primary Years Programme (PYP) of the IB involves a major student exhibition. This exhibition provides the opportunity for students in Year/Grade 6 to engage in sustained project-based learning for a full term, and then present their discoveries at a public presentation. Likewise, the Middle Years Programme (MYP) personal project is a major piece of work spanning around three school terms. In the exhibition and the personal project, students provide evidence of their 'approaches to learning' (ATL), which comprises ten major elements that span PYP, MYP and the Diploma Programme (Table 3.1).

MELT facets directly connect to the ATL, so I ran IB teacher professional development sessions that focused on the use of the MELT pentagon as a way that students and teachers could engage directly with ATL. Students in government and non-government schools in three Australian states and New Zealand used MELT to plan out the beginning of their exhibition (Year 6) or personal project (Year 9/10). There was a demand for these sessions because schools identified the beginning phase of research in the Exhibition and the Personal Project to be a conceptual challenge that was, at times, daunting. Teacher Professional Development on MELT in the IB was provided on school sites and in state associations. These MELT workshops were

Table 3.1 The international baccelaureate's approaches to learning, mapped onto the MELT facets (see www.wcpss.net/Page/15023)

Approaches To learning	MELT facet
Collaboration skills	Explicitly mentioned in *embark & clarify*, *organise & manage*, *analyse & synthesise*, and *communicate & apply*
Communication skills	*Communicate & apply*
Organisation	*Organise & manage*
Reflection	*Evaluate & reflect*
Information literacy	The six facets of MELT are based on six Information Literacy Standards []
Critical thinking	The six facets, modified as appropriate, represent the breadth of critical thinking
Media literacy	The six facets, modified as appropriate, represent the breadth of media literacy
Affective	Each facet has an affective component that is integral
Creative thinking	'Creative' is positioned as an affective side to 'analyse and synthesise'
Transfer	'Apply' overlaps with this

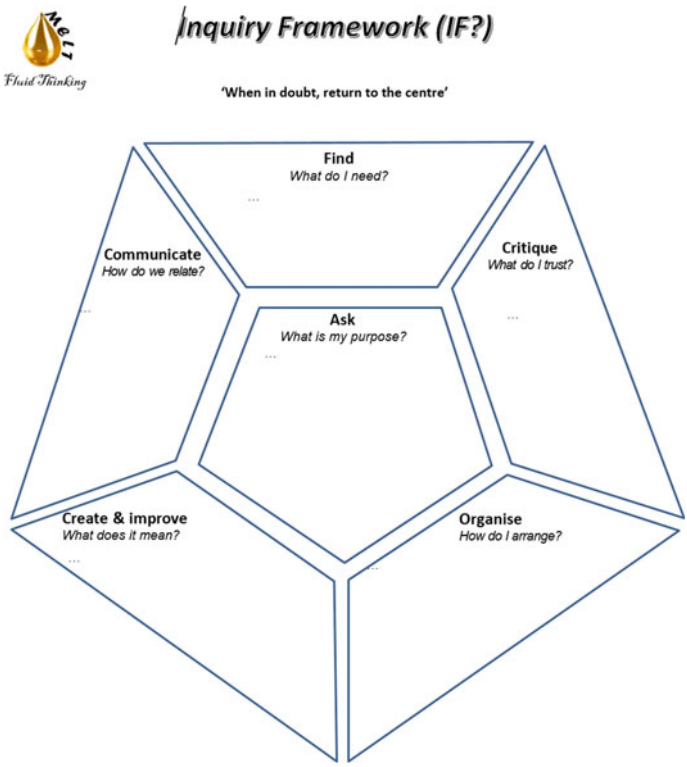


Fig. 3.3 The Inquiry framework (IF), used directly with Year 6 students, so they can improve their understanding of their learning and communicate their reflective thinking. https://www.adelaide.edu.au/melt/k-12-education#primary

requested to better assist students to directly engage with, and become increasingly aware of, their own approaches to learning and how to represent that learning in an assessable 'Process Journal' (Fig. 3.3).

3.2.4 Year 8 Subject-Specific: *A Case Study*

High School specific resources are available at https://www.adelaide.edu.au/melt/k-12-education#secondary

A specific set of resources for high school is called *writE science* (Writing and Reading Integrated with Talking about Experiments) which integrates a MELT framework developed for Year 8 Science and presents explicit ways of developing the facets. *WritE* science has been used to inspire otherwise uninterested students to

engage in hands-on labs to foster literacy—reading and writing. In effect, the strategy provides a platform where an individual student's preferences and strengths maybe used to address areas of weaker ability.

Specifically, *writE science* resources were developed and used across school terms, where these worksheets were applied each week to model and scaffold the skills that students need to gain so they can work towards carrying out an open-ended inquiry. Initially, writE resources present prescribed interventions early in the first term. These worksheets guide students through bounded, scaffolded, and then open-ended activities. In the last three weeks of term, students engage in inquiry projects.

Subsequently, a similar structure has been used at other levels, because the design is adaptable and widely-valued. This application has supported learning for first year university students, master's students, and Year 2 primary students.

The following writeE worksheets illustrate how much detail, examples, help and modelling students may need to learn to be able to observe (generate data), to reflect, to analyse and to organise. The *prescribed* end of the autonomy continuum is as enduringly important for student learning as the *unbounded* end. As indicated in the resource below, it is valuable to provide examples of some of the scaffolding processes from *prescribed* to *open-ended*, so that students will be able to improve and work towards performing a skill.

The left-hand screen grabs are provided as images, not to be read, to give you an overarching sense of the process used. The resources are available at https://www.adelaide.edu.au/rsd/schooling/secondary/resources/.


writE 2 **Observation**

Your Name .....Date.....

Have you heard the expression 'I couldn't believe my eyes'? Many explorers roaming across the deserts of Australia saw water in the distance. But when they rushed up to have a drink, they swallowed a mouthful of sand. It was not water they saw, but a mirage.

These explorers soon learned not to trust their sense of sight only - they realized they needed to use other **senses** too. Our senses are sight, hearing, touch, taste and smell, and these are our main ways of finding out about the world. We should use as many senses as possible in science. In this way we may not be so easily tricked by mirages.

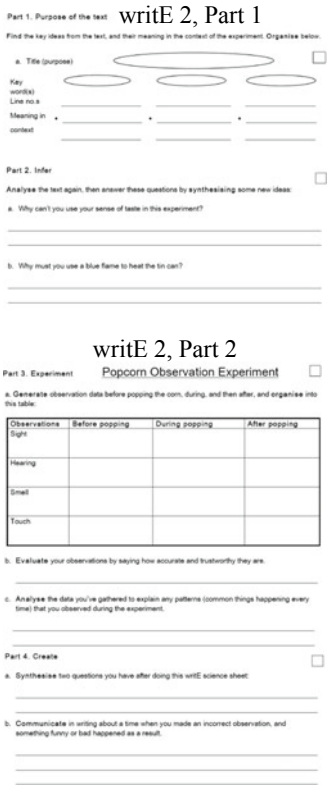
In science, as you explore amazing things in this world, you need to make accurate **observations**. Observations are what we can say about things we see, hear, smell, taste and touch. We can also use measuring equipment to help us with observations. In the experiment today, you will need to use four of these five senses to make some accurate observations. Your group should aim to make the best set of observations in the following experiment.

Experiment: Pop the corn

Equipment: Small tin can, with 20 kernels of corn
Bunsen Burner matches
Tripod bench protector
Gauze mat safety glasses

Method: The method tells you the steps to follow.
1. Make as many observations about the unpopped corn as possible. Record these.
2. Place the tin can with the corn kernels on the gauze mat. Light the Bunsen burner, and begin heating on a blue flame.
3. Use every sense, except taste, to make observations from the time you start to heat.
4. Clean up thoroughly.

As a part of a set, this *writE science* sheet, writE 2, Observation, provided early in a school term, gives students a highly predictable structured text that makes student note-taking in the 'structured overview' much more effective. The sheet has metacognitive and learning management strategies (e.g., tick boxes) built-in. It explicitly nurtures all six facets in a prescribed way, and focuses on observation skills for generating data.


writE 2, Part 1

Part 1. Purpose of the text

Find the key ideas from the text, and their meaning in the context of the experiment. Organise below.

a. Title (purpose)

Key word(s)
Line no.s
Meaning in context

Part 2. Infer

Analyse the text again, then answer these questions by synthesising some new ideas:

a. Why can't you use your sense of taste in this experiment?

b. Why must you use a blue flame to heat the tin can?

writE 2, Part 2

Part 3. Experiment Popcorn Observation Experiment

a. Generate observation data before popping the corn, during, and then after, and organise into this table:

Observations	Before popping	During popping	After popping
Sight			
Hearing			
Smell			
Touch			

b. Evaluate your observations by saying how accurate and trustworthy they are.

c. Analyse the data you've gathered to explain any patterns (common things happening every time) that you observed during the experiment.

Part 4. Create

a. Synthesise two questions you have after doing this writE science sheet:

b. Communicate in writing about a time when you made an incorrect observation, and something funny or bad happened as a result.

It may be easier for students to find appropriate sources in a web search than to find information in the writE texts. So writE 2, Part 1 requires students to find keywords, the line numbers the words fall on, and the supporting details.

Using that knowledge base, students draw inferences through analysis of text and their previous experience. For this exercise, students' observation skills are nurtured through a structure which organises the observation data they generate.

WritE science helps to differentiate the curriculum by using a structure, and after students demonstrate proficiency, say in note-taking, they may leave out similar sections.

The six facets are needed for the skills of observation (writE 2, Part 2), inference, hypothesising and posing researchable questions in (relating to independent and responding variables). Week after week, these skills are introduced, each drawing on the six MELT facets and increasing autonomy.

Observational skills are facilitated in this writE lab with a focus on four senses. In science labs, teachers often ask ambiguous questions, such as 'what happens to the popcorn when heated?' The question is ambiguous because there is a big difference between observations about 'what happens to popcorn *while* it is being heated?' and 'what happens to popcorn *after* it has been heated?' Requiring students to write down observations of an initial state helps them generate a baseline from which to compare. This process goes beyond mere observing; it is the *generation of data.* Following a focus on observation skills, write Science sheets are used for students to infer, identify independent, responding and controlled variables, hypothesise and pose researchable questions. These resources together develop student sophisticated thinking in a science lab context towards a culminating lab experience; designing their own experiment in writE Science 10.

writE 10

Design your own seed experiment

Your Name ..... Date .....

What are they waiting for? You planted those pea seeds a month ago and they still haven't come up. Sure, the pack said 'sow in spring' and you planted them in July, but so what? They had lots and lots and lots of rain, so it couldn't be anything to do with water, could it? Now, the soil was kind of sandy, but the grass grows fine on that, it seems, so that shouldn't affect anything.

Your saucepan is ready to cook fresh, green, delicious home-grown peas, but the peas haven't even shown a little leaf. Maybe it's time to investigate what things affect seeds sprouting. Otherwise, you may never get those home-grown peas you want.

You need to think about a **hypothesis**, which will give you a direction to research. A hypothesis is a 'mini theory'. To come up with one, ask yourselves 'what things might cause seeds to sprout?' Your hypothesis will be about the effect of one of these things. It is a good hypothesis if it helps you decide how to design your experiment. For example, your hypothesis might be:

'The longer the seeds have been in the packet, the longer they take to sprout.'

You could even write it as a question:

'Does the time seeds have been in the packet affect how quickly they sprout?'

Next you must decide the one manipulated variable. This is the variable you decide to change. This is related to your hypothesis. In the example above, you would manipulate the amount of time seeds have been in the packet, by using packets with different use-by dates.

Then you must identify all the **controlled variables**. Remember, these could vary, but you must control them so they don't. Controlled variables would include things like:

- amount of water
- temperature
- soil type
- light conditions
- humidity
- seed type
- amount of air available

If they vary, it will not be a fair test.

You must also state your **dependent variable**. This is the thing you are going to measure. For example, is it the number of seeds that sprout, or the average height the seeds grow to in a certain time, or something else?

Importantly, you must show the design of the experiment, including the equipment you need. You must design your experiment to find evidence to confirm or deny your hypothesis. This is a very important step as it determines whether you conduct a fair test.

In an open-ended group project (writE 10), students generated their own research questions as a culmination of their saffolded learning. This sheet was the last in the sequence, built on science-specific skills, and revisited all six facets time and again.

The format repeats, enabling the differentiation mentioned above, while autonomy increases over the term. The reading to the left reiterates experimental design considerations.

writE 10, Part 1

Part 1. **Purpose** of the text

Find the key ideas from the text, and their meaning in the context of the experiment. **Organise** below:

a. Title (purpose)

Key word(s)

Meaning in context

Part 2. Summary paragraph.

a. **Organise** the structured overview above into a summary paragraph that contains all the key ideas.

b. **Analyse** the text again, and communicate what you think is the key theme of the passage.

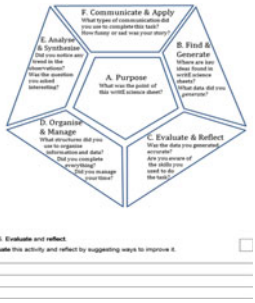
Part 3. **Synthesise** inferences in response to these questions:

a. Why must all the 'controlled variables' be kept the same through your experiment?

b. What would happen if you had two 'manipulated variables' at once?

The well-structured text above provides students with relevant knowledge on processes which they must use in writE 10, Part 1. Some students still need to take notes, and space is provided for this in the structured overview to the left. Others who have demonstrated proficiency can move directly into addressing the complexities of their experimental design.

writE 10, Part 3



Part 5. **Evaluate** and **reflect**.

Evaluate this activity and reflect by suggesting ways to improve it.

For students who demonstrated competency early in the *writE science* sheets, the MELT Pentagon in writE 10, Part 3 asks them questions that related to each facet. The design encourages students to reflect on their own thinking.

Finally, a story or application of the exercise provided a creative way for students to synthesise their learning.

Perhaps the simplest way to see the embedded differentiation in writE is to view the structure across a school term in resources 1, 2, 3, 4, 7 and 10 at https://www.adelaide.edu.au/rsd/melt/k-12-education#secondary .

By revisiting *writE science* in different terms, participating students engage with numerous ways of generating data. These methods of data generation require them to employ a variety of techniques from descriptive observation to measurement. By connection, students begin to understand that others' information has also been 'generated'. For students, this inquiry raises valuable questions about the trustworthiness of others' information, because they realise all information has a similar epistemological status to their own data.

These ideas of connecting specific tasks and skills to MELT facets happened throughout the term in writE. Later in the school term, students were given a task that facilitated their application of the Year 8 biology skills to the design of their own experiment. In contrast with the popcorn example, there was no procedure given for data generation. Small groups of three students needed to devise their own question, including independent and dependent variables (*embark & clarify*), determine their own method of generating relevant data and apply it to the other four facets of MELT. This scientific strategy remains steeped in the literacy strategy and both have structural similarities of prescribed research to open-ended research. The aim is to facilitate student movement from *emulating* to *improvising* to *innovating*.

3.2.5 Year 7–10 High School Transdisciplinary Projects

In this case, students were provided with workshops that introduced each school's version of MELT, often named the Investigation Framework, for Year 9 or 10. The introduction required students to reveal the sophisticated thinking they used in a highly interactive learning task run during the workshop. Based on their own ways of explaining their thinking, the six facets were introduced and mapped onto their own thinking, so that the students could connect with the wording (Fig. 3.4).

Another approach provides a MELT pentagon which explains the facets in a rudimentary way. Then, students are invited to apply the six facets to a scenario, such as a climactic scene in a widely-viewed movie like *Apollo 13*. Equipped with this group practice of mapping MELT to skills used in the movie, students use the MELT to plan for and reflect on what they will need to learn in order to complete their sustained transdisciplinary projects.

3.2.6 Technical Education

In Technical and Further Education, the Innovative High Achieving Template for Enhancing Maths was developed as a tool for enhancing learning and supporting numeracy skills (Fig. 3.5), with its consoling motto, 'Keep calm, and carry a pentagon'.

What skills did you use to do that?

MELT Facets	Your Analysis
Embark and clarify	Open minded – question – thinking differently
Find and generate	Summarizing- focusing in other idea's
Evaluate and reflect	Evaluating – challenging someone's idea
Organise and manage	Collaborating – work together. Time management. Organising. Multitasking
Analyse and synthesise	Thinking critically- critising advantages. Creative thinking – imagining the test and driving the hours
Communicate and applying	Communication- talking- took turns – listening- quiet – eye contact – open body language. Engaging – acknowledging. Applying someone else's idea.

Fig. 3.4 Skills that students identify that they use to engage in inquiry mapped onto MELT facets. Right column—student inventory of skills used during a learning activity in a workshop. Left column skills are matched with the MELT facets on the left

Fig. 3.5 The innovative high achieving template for enhancing maths. https://www.adelaide.edu.au/melt/conferences/short-papers-arranged-by-theme#keep-calm-and-carry-a-pentagon

3.2.7 Undergraduate

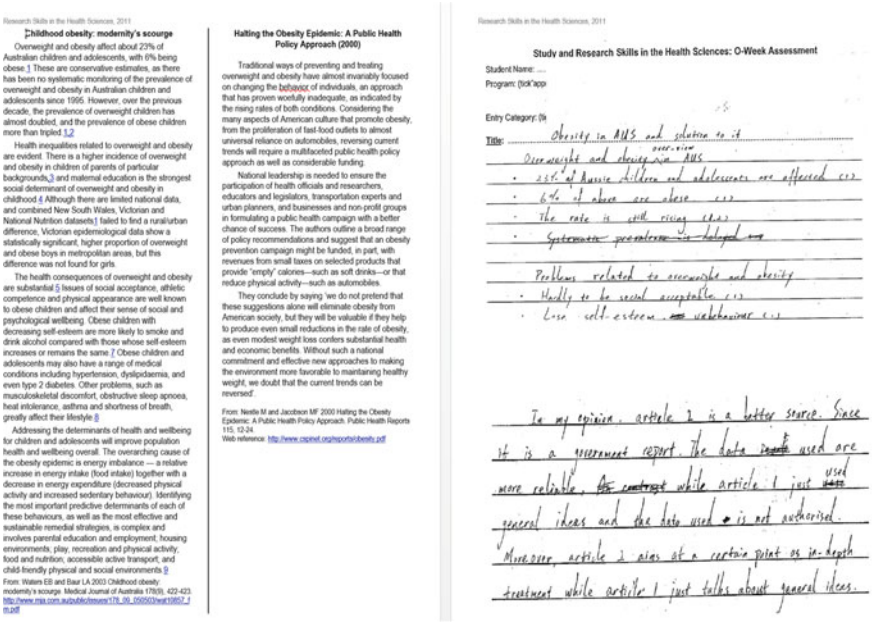
Many discipline-specific examples of MELT, especially in terms of assessment, at the undergraduate level are found at: https://www.adelaide.edu.au/rsd/examples/discipline/.

Much of the MELT evaluation studies have been conducted at the undergraduate level. One major study spanned 29 courses in five universities [2] and found that in the timeframe of a semester, explicit skill development makes a substantial difference in student learning. However, it was also found that there was a risk that the thinking skills developed may atrophy. A follow-up series of studies looked at the explicit use of MELT across multiple semesters of a degree in Media [3, 4], Oral Health [5] and Animal Science [6].

An example of MELT use across two semesters is in first year human biology, using the Research Skill Development framework: https://www.adelaide.edu.au/melt/university-learning#discipline

Some aspects of this use follow (Figs. 3.6, 3.7, and 3.8).

The rubric below is available in Word form www.adelaide.edu.au/rsd/examples/discipline/#humanbiology as are dozens of discipline- and task-specific rubrics. Comparing the rubric below with the one above, both use the six facets, but with criteria specific to the task. The above rubric is for a *bounded* activity, and has two levels


Research Skills in the Health Sciences, 2011

Childhood obesity: modernity's scourge

Overweight and obesity affect about 23% of Australian children and adolescents, with 6% being obese.1 These are conservative estimates, as there has been no systematic monitoring of the prevalence of overweight and obesity in Australian children and adolescents since 1995. However, over the previous decade, the prevalence of overweight children has almost doubled, and the prevalence of obese children more than tripled.1,2

Health inequalities related to overweight and obesity are evident. There is a higher incidence of overweight and obesity in children of parents of particular backgrounds,3 and maternal education is the strongest social determinant of overweight and obesity in childhood.4 Although there are limited national data, and combined New South Wales, Victorian and National Nutrition datasets1 failed to find a rural/urban difference, Victorian epidemiological data show a statistically significant, higher proportion of overweight and obese boys in metropolitan areas, but this difference was not found for girls.

The health consequences of overweight and obesity are substantial.5 Issues of social acceptance, athletic competence and physical appearance are well known to obese children and affect their sense of social and psychological wellbeing. Obese children with decreasing self-esteem are more likely to smoke and drink alcohol compared with those whose self-esteem increases or remains the same.7 Obese children and adolescents may also have a range of medical conditions including hypertension, dyslipidaemia, and even type 2 diabetes. Other problems, such as musculoskeletal discomfort, obstructive sleep apnoea, heat intolerance, asthma and shortness of breath, greatly affect their lifestyle.8

Addressing the determinants of health and wellbeing for children and adolescents will improve population health and wellbeing overall. The overarching cause of the obesity epidemic is energy imbalance — a relative increase in energy intake (food intake) together with a decrease in energy expenditure (decreased physical activity and increased sedentary behaviour). Identifying the most important predictive determinants of each of these behaviours, as well as the most effective and sustainable remedial strategies, is complex and involves parental education and employment; housing environments, play, recreation and physical activity; food and nutrition; accessible active transport; and child-friendly physical and social environments.9

From: Waters EB and Baur LA 2003 Childhood obesity: modernity's scourge. Medical Journal of Australia 178(9), 422-423. http://www.mja.com.au/public/issues/178_09_050503/wat10857_fm.pdf

Halting the Obesity Epidemic: A Public Health Policy Approach (2000)

Traditional ways of preventing and treating overweight and obesity have almost invariably focused on changing the behavior of individuals, an approach that has proven woefully inadequate, as indicated by the rising rates of both conditions. Considering the many aspects of American culture that promote obesity, from the proliferation of fast-food outlets to almost universal reliance on automobiles, reversing current trends will require a multifaceted public health policy approach as well as considerable funding.

National leadership is needed to ensure the participation of health officials and researchers, educators and legislators, transportation experts and urban planners, and businesses and non-profit groups in formulating a public health campaign with a better chance of success. The authors outline a broad range of policy recommendations and suggest that an obesity prevention campaign might be funded, in part, with revenues from small taxes on selected products that provide "empty" calories—such as soft drinks—or that reduce physical activity—such as automobiles.

They conclude by saying 'we do not pretend that these suggestions alone will eliminate obesity from American society, but they will be valuable if they help to produce even small reductions in the rate of obesity, as even modest weight loss confers substantial health and economic benefits. Without such a national commitment and effective new approaches to making the environment more favorable to maintaining healthy weight, we doubt that the current trends can be reversed'.

From: Nestle M and Jacobson MF 2000 Halting the Obesity Epidemic: A Public Health Policy Approach. Public Health Reports 115, 12-24.
Web reference: http://www.cspinet.org/reports/obesity.pdf

Research Skills in the Health Sciences, 2011

Study and Research Skills in the Health Sciences: O-Week Assessment

Student Name: ...
Program: (tick'app

Entry Category: (ti

Title: Obesity in AUS and solution to it
over-view
Overweight and obesity in AUS
- 25% of Aussie children and adolescents are affected (1)
- 6% of above are obese (1)
- The rate is still rising (1.2)
- ~~Systematic prevention is helped by~~

Problems related to overweight and obesity
- Hardly to be social acceptable (1)
- Lose self-esteem, ~~and~~ behaviour (1)

In my opinion, article 2 is a better source. Since it is a government report. The data ~~[illegible]~~ used are more reliable. ~~As [illegible]~~ while article 1 just ~~[illegible]~~ used general ideas and the data used ~~[illegible]~~ is not authorised. Moreover, article 2 aims at a certain point as in-depth treatment while article 1 just talks about general ideas.

Fig. 3.6 First year human biology diagnostic task: Early in the first semester, students were given two sources (left) from which they were required to take hierarchically structured notes (right). These notes were assessed according to the six facets as used in a task-specific marking rubric (Fig. 3.7).

Research Skills in the Health Sciences, 2011

Marking Criteria for 'O-Week' Research Skills Evaluation

Student Name: _____ Student ID: _____

Marker: _____

Indicators ***The student with research skill ...***	**Level 1** Student engages with a closed enquiry and requires a high degree of structure and guidance	**Level 2** Student engages with a closed enquiry and requires some structure and guidance
*1. **embarks on inquiry** and so determines a need for knowledge/understanding*	❑ Identifies some *peripheral* or *duplicated* ideas as key	❑ Identifies KEY ideas
*2. **finds/generates** needed information/data*	❑ Points/notes generated partially relate to the headings under which they are listed ❑ Notes produced are sourced predominantly from 1 text only	❑ Points/notes generated elaborate on the key ideas to which they are linked ❑ Notes produced draw on ideas from both texts
*3. **critically evaluates** information/data and the process to find/generate*	❑ Identifies indicators of source credibility and reliability but does not fully apply them in evaluating data or process	❑ Identifies several relevant indicators of source credibility and reliability and provides appropriate rationale for usage/inclusion of information
*4. **organises** information collected or generated*	❑ Has attempted a note-taking framework, but information is organised predominantly as a list of undifferentiated bullet points	❑ Uses a hierarchical note-taking framework that organises related information under the appropriate key headings.
*5. **analyses and synthesises** new knowledge*	❑ Produces point form notes (information not directly copied or sentence format) but notes separated according to source	❑ Combines and integrates ideas/data from different sources to generate notes
*6. **applies and communicates** knowledge with understanding and acknowledges cultural, ethical, economic, legal and social issues*	❑ Title is present ❑ Partial and/or incorrect acknowledgement of sources of information	❑ Title relates clearly to the key ideas presented in the notes ❑ Full and correct acknowledgement of sources of all noted information

Fig. 3.7 The rubric structure framed by the six MELT facets was used consistently for assessments throughout two consecutive semesters. The rubric below is specific to a bounded investigation, and Fig 3.9 is for an open-ended investigation, where the facet similarities allowing students to connect the skill set they have been building throughout the year due to the consistent use of MELT facets

Fig. 3.8 Students engaged in an open-ended group project gather life data from tombstones to address their own research question

delineating student autonomy. The rubric below is for an open-ended activity, and so delineates *learning autonomy* into four levels, in the context of the competence expected in first year biology (Fig. 3.9).

Outcomes of this style of use of the RSD have shown substantial benefits for university students in a variety of disciplines and universities [2].

First Year Mechanical Engineering: *Optimising Problem Solving Pentagon*
In 2014, upper-level undergraduate mechanical engineering tutors (University of Adelaide) found that their first year students were not enthusiastic about learning to communicate in a course that focussed on graphic, written and spoken communication skills. These tutors, themselves second to fourth year undergraduate students, took the broad MELT parameters and created the first pentagon version, for direct use with the first year students they sought to support. Since that version of MELT, many of the models are introduced in a pentagon configuration especially when the explicit representation of students' autonomy may detract from the learning priorities (Fig. 3.10).

Further examples are similar in principle to the human biology rubric above, and include second year, third year and honours learning activities. Many details relating to these activities can be found on the RSD website www.rsd.edu.au.

Outcomes of the use of OPS have shown substantial benefits for First Year Engineering students [7].

ANAT SC 1103 Human Biology IB — Semester 2 2010

Marking Criteria for Population Analysis Report

Student Name: ..... Student Number: ..... Marker: .....

← Level of Student Autonomy →

↓ Facet of Inquiry	Level 1 *Students research at the level of a **closed inquiry** and require a **high degree of structure/guidance***	Level 2 *Students research at the level of a **closed inquiry** and require **some structure/guidance***	Level 3 *Students research **independently** at the level of a **closed enquiry***	Level 4 *Students research at the level of an **open inquiry**, within **structured guidelines***
A. *Students **embark** on inquiry and so **determine a need** for knowledge/ understanding*	❑ Report lacks an explicit statement of Aims (although these may be deduced from report content) and there is no hypothesis	❑ A statement of Aims/hypothesis is present but is either not clearly stated or is inappropriate to the investigation conducted	❑ Report has a clear statement of Aims/hypothesis, that closely reflects exemplars provided in the task guidelines	❑ Aims/hypothesis are clearly stated, focussed and innovative
B. *Students **find/generate** needed information/data using appropriate methodology*	❑ Source of data is cited (cemetery name/location, ABS, etc) but no details of collection protocols provided, or protocols inadequate ❑ Locates literature relevant to the general topic	❑ Data sampling protocols are adequate but not entirely appropriate in addressing aims/hypothesis ❑ Locates more specific literature on at least one aspect of topic	❑ Data gathered are appropriate to aims/hypothesis ❑ Locates specific literature supporting several aspects of topic	❑ Data from a variety of sources or rigorous data collection ❑ Locates specific literature supporting all aspects of topic
C. *Students **critically evaluate** information/data and the process to find/generate it*	❑ No awareness of study limitations and biases but an attempt at critical analysis via completion of report self evaluation	❑ Report self evaluation + Limitations or biases of the study design or data collection methods are stated/addressed	❑ Report self evaluation + Limitations and biases of the study design or data collection methods are stated/addressed	❑ Evaluation of the whole study design is rigorous
D. *Students **organise** information collected/ generated*	❑ Data are gathered but are not presented in a report writing structure Missing _____	❑ Data are incorporated into a report writing structure but there is no clear linkage between sections Poor linkage of _____	❑ Report writing conventions are generally followed with coherent flow Areas for improvement: _____	❑ Report writing conventions are followed completely
E. *Students **synthesise, analyse** and **apply** new knowledge*	❑ There is limited synthesis of study data with existing literature ❑ Results are restated with minimal analysis and discussion	❑ Study data are compared or contrasted with existing literature ❑ Analysis & discussion of data, but misinterpretations/ inappropriate conclusions	❑ Study data are compared and contrasted with existing literature ❑ Analysis & discussion of data is appropriate but omissions evident	❑ Synthesis of study data with that from other studies is rigorous ❑ Analysis & discussion of data is comprehensive
F. *Students **communicate** knowledge and the processes used to generate it, with an awareness of ethical, social and cultural issues*	❑ Title is present ❑ Sources are cited in the text and LOR, but Harvard referencing style is not applied	❑ Title portrays a general sense of the study content ❑ Sources are cited in the text and LOR using Harvard referencing style but it is inconsistently applied or many minor style errors are present	❑ Title succinctly portrays the full dimensions of the study ❑ Sources are cited in the text and LOR and Harvard referencing is consistently applied although a few minor style errors are present	❑ Title succinctly portrays a study from an "original" perspective ❑ A range of sources is cited in the text and LOR and Harvard referencing is consistently and accurately applied

Fig. 3.9 MELT facets frame the assessment rubric for *open-ended* human biology field research conducted in first year university

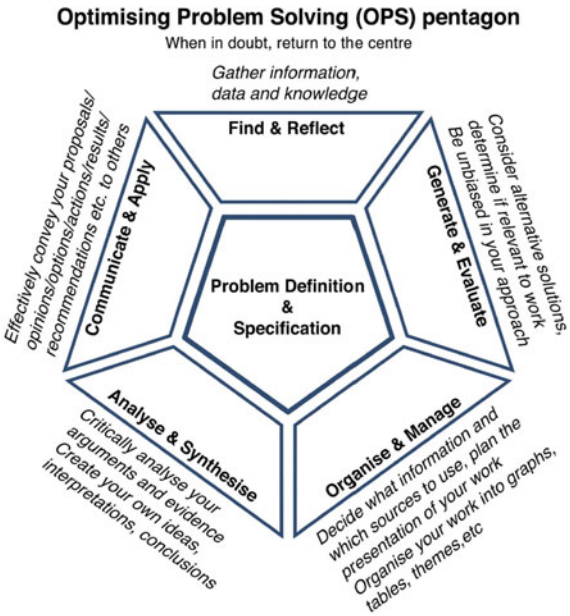


Fig. 3.10 The optimising problem solving pentagon. https://www.adelaide.edu.au/melt/ua/media/24/ops_rev5-1.pdf

Table 1: Work Skill Development framework

WSD

For the explicit and coherent development of student employability skills

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www.melt.edu.au

Level of Autonomy → / Work Skill Facet, where each student demonstrates:	Prescribed Direction *Highly structured directions & guidance from mentor, where student…*	Bounded Direction *Boundaries & limited direction from mentor, where student…*	Scaffolded Direction *Works independently & within guidelines provided by mentor, where student…*	Open-ended *Student develops own abilities & works innovatively with limited guidance, to…*	Unbounded *Works within self-determined guidelines which are context appropriate to …*
INITIATIVE *What is my role?* Goal directed and motivated to clarify role and adapt to new situations, mindful of ethical, cultural, social/team issues.	Identifies role relying on a high degree of guidance & taking into account ethical, cultural, social/ team considerations.	Identifies & clarifies role with some degree of guidance, including ethical, cultural, social/ team issues.	Adapts to role independently & with minimal guidance to achieve the placement requirements.	Critically evaluates role and is creative in identifying new opportunities, while addressing original requirements of placement.	Determine future goals & projects to create innovative, strategic outcomes, while satisfying original requirement.
RESOURCEFULNESS *What do I need?* Find and generate information, data/ & ideas using appropriate resources, technology and digital skills	Uses basic technology & digital skills with a high degree of guidance to find & generate information /data.	Uses technology & digital skills with some degree of guidance to find & generate information/data.	Uses technology & digital skills independently to find & generate a range of artefacts, information/data that satisfy placement requirements.	Selects and uses a range of resources and digital tools demonstrating a high degree of sophistication and aptitude, to produce pertinent artefacts, information/data.	Efficiently select and use only the technology and resources needed, demonstrating context-sensitive digital skills.
LIFELONG LEARNING *How do I improve?* Evaluate and reflect on skills required for lifelong learning and work in cross cultural environments.	Uses simple reflective practices to understand others & develop social responsibility.	Displays interpersonal understanding with limited direction to capture diverse beliefs, values, & behaviours.	Uses self-determined criteria to align behaviour with organisational culture & protocols.	Using a high degree of sensitivity, critically evaluates interpersonal & cross cultural environments.	Demonstrates inclusive practice for achieving a healthy organisational culture & responsibility for develop-ment of others and self.
SELF-MANAGEMENT *How do I arrange?* Organise and manage self while being perceptive to managing the needs of others.	Organises information & establishes role using a prescribed structure.	Organises information & establishes clear project goals & deliverables with limited direction.	Organises information using self-determined structures to manage self & needs of others within the placement requirements.	Organise & manage time & resources, & plan for contingencies while prioritising tasks for self and others.	Organise information to articulate visions, goals & innovative strategies in managing and socialising teams.
PROBLEM SOLVING *How do I create?* Critically analyse and synthesise information to identify problems, consolidate strengths, create solutions and initiate necessary change	Applies a simple structure to understand the placement context & contribute towards creating solutions	Applies a structured format to interpret & synthesise existing information to create solutions for pre-identified problems.	Interprets and synthesises given information and data independently & applies new understanding to prioritise problem solving	Applies critical thinking & works collaboratively to analyse, synthesise and produce innovative & creative solutions to self-identified problems.	Applies critical thinking & work collaboratively to analyse, synthesise, produce & implement pertinent solution & to extrapolate outcomes.
COMMUNICATION & TEAMWORK *How do I relate?* Communicate with professionalism and show sensitivity in interpersonal communication, heeding ethical, cultural, social/team (ECST) issues.	Uses prescribed structures that model interpersonal & cultural considerations, to interpret spoken, written & non-verbal communication	Communicates using prescribed language and genre to understand interpersonal & cross cultural communication.	Communicate using appropriate language & assertiveness in sharing information and providing feedback.	Communicates professionally and openly with teams using mutual respect & shared understanding, including provision of, and response to, constructive feedback.	Communicates with a high degree of inter-personal and cultural sensitivity in asserting own values & respecting those of others in the team.

Fig. 3.11 The work skill development (WSD) framework. https://www.adelaide.edu.au/monash.edu/__data/assets/pdf_file/0005/1719401/WorkSkillsDevt-2019.pdf.

3.2.8 Work Integrated Learning

The RSD framework, the first of the MELT has been used to assist in evaluating learning that takes place in industry settings. However, since the terminology of research may not resonate with most employers, Sue Bandaranaike from James Cook University adapted the RSD to develop the Work Skill Development (WSD) framework. Sue Bandaranaike envisioned that the WSD would be used with students and their employers during co-ops, internships, and other work placements—collectively called Work Integrated Learning. WSD use in employment contexts has led to a number of benefits for students, especially their capacity to articulate employability skills [8] (Fig. 3.11).

3.2.9 Course-Based Master's Degree Programmes

MELT has been used in assessment orientations, in ways similar to first year biology examples. Numerous resources, such as examples, tools, descriptions and peer-reviewed journal articles, are available on a master's-specific subsite of the MELT site https://www.adelaide.edu.au/melt-1.dev.openshift.services.adelaide.edu.au/melt/university-learning#masters-by-coursework.

3.2.10 Academic Research: Doctoral, Master's and Early Career Research (ECR)

The Researcher Skill Development framework comprising a learning autonomy continuum delineated into seven levels, the RSD7, was formulated to bring in the unequivocally capital 'R' research into the learning process. The RSD7 can be useful for direct conversations with postgraduate doctoral degree (Ph.D.) students and early career researchers who are thinking about their academic trajectory. It enables conversations or personal reflections on what capacities and skills a researcher can employ, which skills and level of autonomy they seek to develop for the future, and ways to achieve skills and increased autonomy. A study showed substantial benefits arising from the long-term use of the RSD, commencing in Year 1 human biology and then through to the use of the RSD7 in a Ph.D. preparation year (called 'Honours' in Australia) for medical science [9] (Fig. 3.12).

Academic programmes based on sophisticated postgraduate research have also employed MELT successfully. For example, the International Bridging programme at the University of Adelaide asked each doctoral student and their supervisor to assess the student's research proposal using a six-level marking rubric based on the RSD. An article explains the processes used, including the specific marking rubric generated and outcomes on the process [10] (Fig. 3.12).

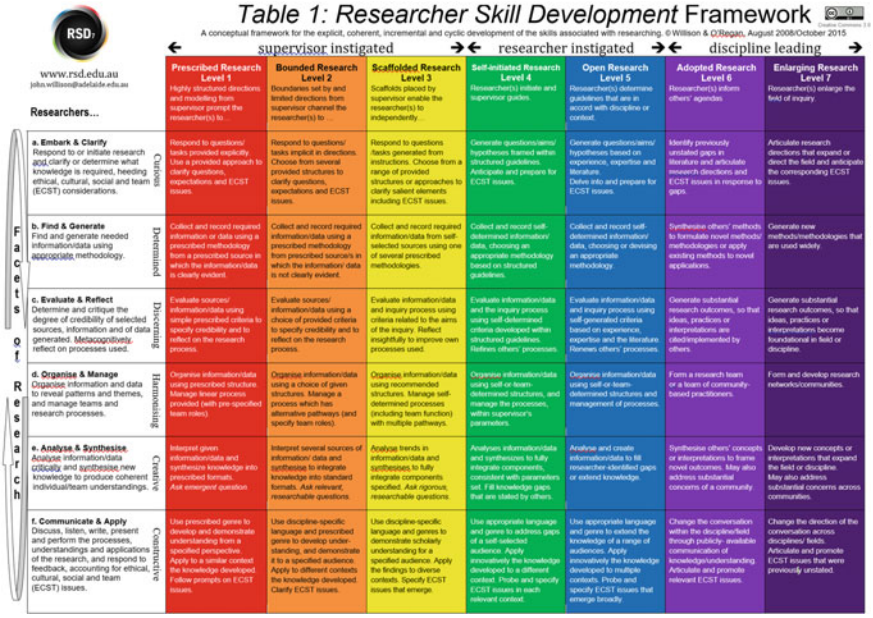


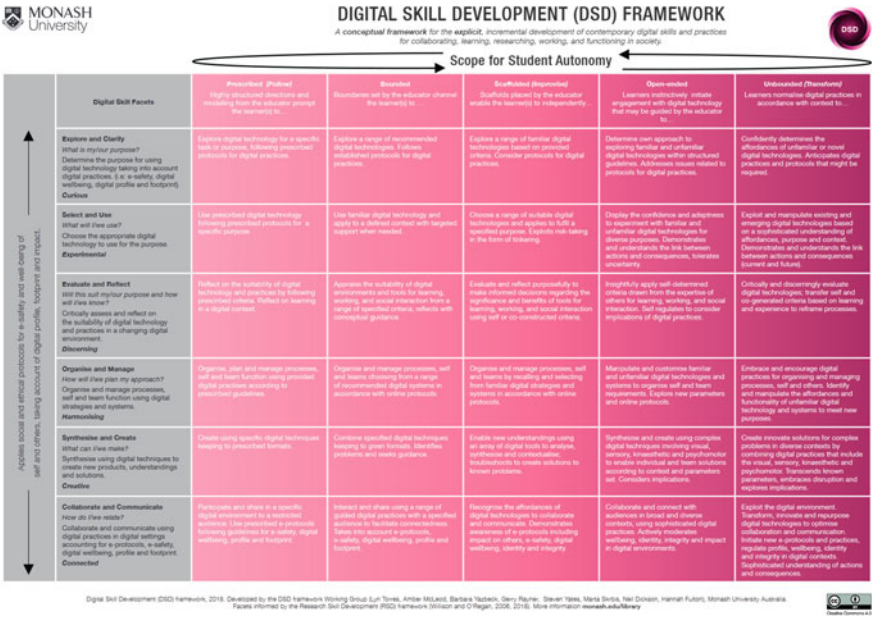
Table 1: Researcher Skill Development Framework

A conceptual framework for the explicit, coherent, incremental and cyclic development of the skills associated with researching. © Willison & O'Regan, August 2008/October 2015

www.rsd.edu.au
john.willison@adelaide.edu.au

Researchers...		supervisor instigated			researcher instigated		discipline leading	
		Prescribed Research Level 1 Highly structured directions and modelling from supervisor prompt the researcher(s) to .	Bounded Research Level 2 Boundaries set by and limited directions from supervisor channel the researcher(s) to .	Scaffolded Research Level 3 Scaffolds placed by supervisor enable the researcher(s) to independently .	Self-initiated Research Level 4 Researcher(s) initiate and supervisor guides.	Open Research Level 5 Researcher(s) determine guidelines that are in accord with discipline or context.	Adopted Research Level 6 Researcher(s) inform others' agendas	Enlarging Research Level 7 Researcher(s) enlarge the field of inquiry.
Facets of Research								
a. Embark & Clarify Respond to or initiate research and clarify or determine what knowledge is required, heeding ethical, cultural, social and team (ECST) considerations.	Clarifying	Respond to questions/ tasks provided explicitly. Use a provided approach to clarify questions, expectations and ECST issues.	Respond to questions/ tasks implicit in directions. Choose from several provided structures to clarify questions, expectations and ECST issues.	Respond to questions /tasks generated from instructions. Choose from a range of provided structures or approaches to clarify salient elements including ECST issues.	Generate questions/aims/ hypotheses framed within structured guidelines. Anticipate and prepare for ECST issues.	Generate questions/aims/ hypotheses based on experience, expertise and literature. Define into and prepare for ECST issues.	Identify previously unstated gaps in literature and articulate research directions and ECST issues in response to gaps.	Articulate research directions that expand or direct the field and anticipate the corresponding ECST issues.
b. Find & Generate Find and generate needed information/data using appropriate methodology.	Determined	Collect and record required information or data using a prescribed methodology from a prescribed source in which the information/data is clearly evident.	Collect and record required information/data using a prescribed methodology from prescribed sources in which the information/ data is not clearly evident.	Collect and record required information/data from self-selected sources using one of several prescribed methodologies.	Collect and record self-determined information/ data, choosing an appropriate methodology based on structured guidelines.	Collect and record self-determined information/ data, choosing or devising an appropriate methodology.	Synthesise others' methods to formulate novel methods/ methodologies or apply existing methods to novel applications.	Generate new methods/methodologies that are used widely.
c. Evaluate & Reflect Determine and critique the degree of credibility of selected sources, information and of data generated. Metacognitively, reflect on processes used.	Discerning	Evaluate sources/ information/data using simple prescribed criteria to specify credibility and to reflect on the research process.	Evaluate sources/ information/data using a choice of provided criteria to specify credibility and to reflect on the research process.	Evaluate information/data and inquiry process using criteria related to the aims of the inquiry. Reflect insightfully to improve own processes used.	Evaluate information/data and the inquiry process using self-determined criteria developed within structured guidelines. Refines others' processes.	Evaluate information/data and inquiry process using self-generated criteria based on experience, expertise and the literature. Renews others' processes.	Generate substantial research outcomes, so that ideas, practices or interpretations are cited/implemented by others.	Generate substantial research outcomes, so that ideas, practices or interpretations become foundational in field or discipline.
d. Organise & Manage Organise information and data to reveal patterns and themes, and manage teams and research processes.	Harmonising	Organise information/data using prescribed structure. Manage linear process provided (with pre-specified team roles)	Organise information/data using a choice of given structures. Manage a process which has alternative pathways (and specify team roles).	Organise information/data using recommended structures. Manage self-determined processes (including team function) with multiple pathways.	Organise information/data using self or team-determined structures, and manage the processes, within supervisor's parameters.	Organise information/data using self or team-determined structures and management of processes.	Form a research team or a team of community-based practitioners.	Form and develop research networks/communities.
e. Analyse & Synthesise Analyse information/data critically and synthesise new knowledge to produce coherent individual/team understandings.	Creative	Interpret given information/data and synthesise knowledge into prescribed formats. *Ask emergent question*	Interpret several sources of information/ data and synthesise to integrate knowledge into standard formats. *Ask relevant, researchable questions.*	Analyse trends in information/data and synthesise to fully integrate components specified. *Ask rigorous, researchable questions.*	Analyses information/data and synthesizes to fully integrate components, consistent with parameters set. Fill knowledge gaps that are stated by others.	Analyse and create information/data to fill researcher-identified gaps or extend knowledge.	Synthesise others' concepts or interpretations to frame novel outcomes. May also address substantial concerns of a community.	Develop new concepts or interpretations that expand the field or discipline. May also address substantial concerns across communities.
f. Communicate & Apply Discuss, listen, write, present and perform the processes, understandings and applications of the research, and respond to feedback, accounting for ethical, cultural, social and team (ECST) issues.	Communicative	Use prescribed genre to develop and demonstrate understanding from a specified perspective. Apply to a similar context. the knowledge developed. Follow prompts on ECST issues.	Use discipline-specific language and prescribed genre to develop understanding, and demonstrate it to a specified audience. Apply to different contexts the knowledge developed. Clarify ECST issues.	Use discipline-specific language and genres to demonstrate scholarly understanding for a specified audience. Apply the findings to diverse contexts. Specify ECST issues that emerge.	Use appropriate language and genre to address gaps of a self-selected audience. Apply innovatively the knowledge developed to a different context. Probe and specify ECST issues in each relevant context.	Use appropriate language and genre to extend the knowledge of a range of audiences. Apply innovatively the knowledge developed to multiple contexts. Probe and specify ECST issues that emerge broadly.	Change the conversation within the discipline/field through publicly- available communication of knowledge/understanding. Articulate and promote relevant ECST issues.	Change the direction of the conversation across disciplines/ fields. Articulate and promote ECST issues that were previously unstated.

Fig. 3.12 The researcher skill development (RSD7) framework. https://www.adelaide.edu.au/melt/ua/media/48/rsd7_13nov_15_jm.pdf



MONASH University

DIGITAL SKILL DEVELOPMENT (DSD) FRAMEWORK

*A **conceptual framework** for the **explicit**, incremental development of contemporary digital skills and practices for collaborating, learning, researching, working, and functioning in society.*

Scope for Student Autonomy

Applies social and ethical protocols for e-safety, and well-being of self and others, taking account of digital profile, footprint and impact.

Digital Skill Facets	Prescribed *(Follow)* Highly structured directions and modelling from the educator prompt the learner(s) to...	Bounded Boundaries set by the educator channel the learner(s) to...	Scaffolded *(Improvise)* Scaffolds placed by the educator enable the learner(s) to independently...	Open-ended Learners instinctively initiate engagement with digital technology that may be guided by the educator to...	Unbounded *(Transform)* Learners normalise digital practices in accordance with context to...
Explore and Clarify *What is my/our purpose?* Determine the purpose for using digital technology taking into account digital practices. (i.e. e-safety, digital wellbeing, digital profile and footprint). ***Curious***	Explore digital technology for a specific task or purpose, following prescribed protocols for digital practices.	Explore a range of recommended digital technologies. Follows established protocols for digital practices.	Explore a range of familiar digital technologies based on provided criteria. Consider protocols for digital practices.	Determine own approach to exploring familiar and unfamiliar digital technologies within structured guidelines. Addresses issues related to protocols for digital practices.	Confidently determines the affordances of unfamiliar or novel digital technologies. Anticipates digital practices and protocols that might be required.
Select and Use *What will I/we use?* Choose the appropriate digital technology to use for the purpose. ***Experimental***	Use prescribed digital technology following prescribed protocols for a specific purpose.	Use familiar digital technology and apply to a defined context with targeted support when needed.	Choose a range of suitable digital technologies and applies to fulfil a specified purpose. Exploits risk-taking in the form of tinkering.	Display the confidence and adaptness to experiment with familiar and unfamiliar digital technologies for diverse purposes. Demonstrates and understands the link between actions and consequences, tolerates uncertainty.	Exploit and manipulate existing and emerging digital technologies based on a sophisticated understanding of affordances, purpose and context. Demonstrates and understands the link between actions and consequences (current and future).
Evaluate and Reflect *Will this suit my/our purpose and how will I/we know?* Critically assess and reflect on the suitability of digital technology and practices in a changing digital environment. ***Discerning***	Reflect on the suitability of digital technology and practices by following prescribed criteria. Reflect on learning in a digital context.	Appraise the suitability of digital environments and tools for learning, working, and social interaction from a range of specified criteria, reflects with conceptual guidance.	Evaluate and reflect purposefully to make informed decisions regarding the significance and benefits of tools for learning, working, and social interaction using self or co-constructed criteria.	Insightfully apply self-determined criteria drawn from the expertise of others for learning, working, and social interaction. Self regulates to consider implications of digital practices.	Critically and discerningly evaluate digital technologies; transfer self and co-generated criteria based on learning and experience to reframe processes.
Organise and Manage *How will I/we plan my approach?* Organise and manage processes, self and team function using digital strategies and systems. ***Harmonising***	Organise, plan and manage processes, self and team function using provided digital practices according to prescribed guidelines.	Organise and manage processes, self and teams choosing from a range of recommended digital systems in accordance with online protocols.	Organise and manage processes, self and teams by recalling and selecting from familiar digital strategies and systems in accordance with online protocols.	Manipulate and customise familiar and unfamiliar digital technologies and systems to organise self and team requirements. Explore new parameters and online protocols.	Embrace and encourage digital practices for organising and managing processes, self and others. Identify and manipulate the affordances and functionality of unfamiliar digital technology and systems to meet new purposes.
Synthesise and Create *What can I/we make?* Synthesise using digital techniques to create new products, understandings and solutions. ***Creative***	Create using specific digital techniques keeping to prescribed formats.	Combine specified digital techniques keeping to given formats. Identifies problems and seeks guidance.	Enable new understandings using an array of digital tools to analyse, synthesise and contextualise; troubleshoots to create solutions to known problems.	Synthesise and create using complex digital techniques involving visual, sensory, kinaesthetic and psychomotor to enable individual and team solutions according to context and parameters set. Considers implications.	Create innovate solutions for complex problems in diverse contexts by combining digital practices that include the visual, sensory, kinaesthetic and psychomotor. Transcends known parameters, embraces disruption and explores implications.
Collaborate and Communicate *How do I/we relate?* Collaborate and communicate using digital practices in digital settings accounting for e-protocols, e-safety, digital wellbeing, profile and footprint. ***Connected***	Participate and share in a specific digital environment to a restricted audience. Use prescribed e-protocols following guidelines for e-safety, digital wellbeing, profile and footprint.	Interact and share using a range of guided digital practices with a specified audience to facilitate connectedness. Takes into account e-protocols, e-safety, digital wellbeing, profile and footprint.	Recognise the affordances of digital technologies to collaborate and communicate. Demonstrates awareness of e-protocols including impact on others, e-safety, digital wellbeing, identity and integrity.	Collaborate and connect with audiences in broad and diverse contexts, using sophisticated digital practices. Actively moderates wellbeing, identity, integrity and impact in digital environments.	Exploit the digital environment. Transform, innovate and repurpose digital technologies to optimise collaboration and communication. Initiate new e-protocols and practices, regulate profile, wellbeing, identity and integrity in digital contexts. Sophisticated understanding of actions and consequences.

Digital Skill Development (DSD) framework, 2018. Developed by the DSD framework Working Group (Lyn Torres, Amber McLeod, Barbara Vazbeck, Gerry Rayner, Steven Yates, Marta Sivrbis, Neil Dickson, Hannah Fulcinti), Monash University Australia. Facets informed by the Research Skill Development (RSD) framework (Wilson and O'Regan, 2006, 2018). More information **monash.edu/library**

Creative Commons 4.0

Fig. 3.13 Monash university's digital skill development framework. https://www.monash.edu/__data/assets/pdf_file/0010/1652437/DSD-document.pdf

3.2.11 Interdisciplinary Studies and Digital Literacy

Two transdisciplinary contexts at the master's level that use MELT-informed rubrics include addiction studies and climate change [11]. MELT characteristics provided advantages for facilitating fluid conversations across disciplinary boundaries.

Monash University adapted MELT to be used across disciplines in terms of Digital Literacy, and produced the Digital Skills Development framework (Fig. 3.13).

3.3 Outside the MELT Parameters

MELT characteristics pertain to a broad range of teaching and learning contexts, from early childhood to early career research. However, some contexts have requirements that may fall outside of typical educational settings, but which can still benefit from applying MELT characteristics. One example, provided by the University of Adelaide, consists of a MELT version that has been tailored towards the Peer Assisted Study Scheme (PASS, developed at the University of Wollongong). PASS leaders

Fig. 3.14 The pillars in evaluation (PIE). https://www.adelaide.edu.au/melt/ua/media/27/pie_poster_2017.pdf

started with MELT, and adapted it to include new parameters which were better-suited to their sessions than the existing ones. These were organised around supporting students dropping in and seeking help for academic purposes and personal development. One beautiful characteristic of their model, the Pillars in Evaluation (PIE), was the facet 'dynamism', emphasising the centrality of fluidity (Fig. 3.14).

3.4 Conclusion: Commonality with Adaptability

Kevin, the graduate who recounted using Silver Fluoride in Cambodia experienced an undergraduate degree that used various versions of MELT—including the Research Skill Development framework and the Clinical Reflection Skills framework—in the first four semesters of the Oral Health degree. In the final year of the degree, students were required to engage in open-ended inquiry. Another graduate of the Oral Health programme said about the development of their sophisticated thinking from the first year that:

You have to research it, you don't get fed stuff anymore. You have to go, research it, sit down, analyse what's important and what's not. So yes, it *slowly did lead up to a better research* in the third year. I think if we started researching in the third year, we wouldn't produce a high-quality piece of work at all (italics added) [5].

This graduate appreciated that, as a student, starting the process of developing sophisticated thinking skills from first year enabled those skills to slowly build up and resulted in better research in the final year because of that ongoing, explicit

development. Another graduate of the programme found this scaffolded, incremental, developmental process:

> … encourages all its graduates to have a *mindset of research* on focused learning, lifelong learning and to know that study doesn't stop at the end of the course… (italics added) [9].

The common framing of MELT adapted context-by-context and over time, enables students to take the specifics of any given learning activity, assessment task and individual course and begin to see the big picture by connecting all the parts that may otherwise seem separate. They will perceive, for example, not separate activities, assessments, courses or even separate facet development, but a multifaceted 'mindset of research' or other such sophisticated thinking gems. In a similar vein, a student engaging in the research-oriented fourth year of a Medical Science degree looked back on the use of the MELT and found:

> Since the beginning [of First Year], they have given us assignments based on this criteria. You might not have liked the assignments, but because they have been consistently applying this structure to all of our assignments, we have *come to think that way for science*… [9]

The MELT used as a thinking routine, became for the student a heuristic to think scientifically.

As MELT expands across years of study, disciplines, and learning contexts, students are increasingly likely to be exposed to more than one application of the model. Two of the big advantages of repeat exposure are that (a) it improves student self-assessment and peer assessment, where students become attuned to the standards of the context, and (b) they become better able to work with increasing levels of competency and autonomy in each context.

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