

General Capabilities: their definition, cultivation, assessment and use

# Liliana Ructtinger and Robert Stevens

## With Cheryl Ballantyne, Paul Brock, Elizabeth Callister, Tim Gorrod, Susan Harriman, Hilary Hughes, Shantha Liyanage, Nick Perkins and Patricia Rymer

Recently there has been a growing community expectation that schools should, in addition to providing each student with factual knowledge, or content, also provide students with knowledge of how to do certain things, such as how to read, write and manipulate numbers (the three Rs), how to think well and how to live well. These skills or capabilities are not taught or learned in any one discipline so they are referred to as *general capabilities*.

In this paper we examine what the general capabilities are, how they relate to each other, how they can be cultivated, how they can be assessed, and how curriculum can be designed to best support their cultivation and assessment. We also consider how the general capabilities might be used to integrate and personalise learning. Finally we consider the implications of the need to cultivate general capabilities for teacher education.

# What are the general capabilities?

The 20th Century British Philosopher, Gilbert Ryle distinguished between knowing how to do something (e.g. ride a bike) and knowing that some fact is true (e.g. Canberra is the capital city of Australia). The majority opinion in academic philosophy is that knowledge-how and knowledge-that are distinct kinds of knowledge (Fantl 2012). Knowing-how and knowing–that are not dichotomous. Knowing-how and knowing-that are interrelated. Knowing-how to learn is necessary to learning-that something is the case. Knowing-how to think well involves the ability to “manipulate” content. This distinction is of educational significance since a parallel distinction can be drawn between learning-how and learning-that and also teaching-how and teaching-that. If knowledge-how is different to knowledge-that, capabilities (know-how) might be learned and taught differently from facts.

The distinction between knowledge-how and knowledge-that is related to the ancient distinction between technê and episteme. The ancient Greek philosophers had one word, epistêmê, that is usually translated as knowledge and another, technê, often translated as craft or art (Fantl 2012).

Distinctions have also been made between four interrelated types of knowledge: *declarative*, or “knowing that” regarding factual or conceptual knowledge; *procedural*, or “knowing how” to do something using step-by-step or condition-action reasoning; *schematic*, or “knowing why” knowledge fits a mental model; and *strategic*, or “knowing when and where to apply knowledge” (Li, Ruiz-Primo, & Shavelson, 2006; Shavelson & Ruiz-Primo, 1999).

The issue is not merely theoretical. As we noted above, the community expects that in addition to knowing facts, on emerging from school, young adults will know how to do certain things, such as such as think well and to live well. These expectations are reflected in the *Melbourne Declaration on Educational Goals for Young Australians.*

Goal 1: Australian schooling promotes equity and excellence

Goal 2: All young Australians become successful learners, confident and creative individuals, and active and informed citizens

According to the Melbourne Declaration, successful learners: have the essential skills in *literacy* and *numeracy* and are creative and productive *users of technology*; are able *to think deeply and logically*; are *creative*, innovative and resourceful; are able to *collaborate*; are able to make sense of their world and think about how things have become the way they are.

Confident and creative individuals: are able to “*manage their* emotional, mental, spiritual and physical *wellbeing*; *develop personal* values and *attributes such as honesty, resilience, empathy and respect for others*; have the knowledge, skills, understanding and values to establish and *maintain healthy, satisfying lives*; *relate well to others* and form and *maintain healthy relationships*.

Active and informed citizens: *act with moral and ethical integrity*; are able to *relate to and communicate across cultures*, and *work for the common good*.

Informed by the Melbourne Declaration, The Australian Curriculum Assessment and Reporting Authority (ACARA) has identified seven general capabilities as a key dimension of the Australian Curriculum. They encompass the knowledge, skills, behaviours and dispositions that, together with curriculum content in each learning area and the cross-curriculum priorities, will assist students to live and work successfully in the twenty-first century. These are:

·         Literacy

·         Numeracy

·         Information and communication technology capability

·         Critical and creative thinking

·         Personal and social capability

·         Ethical understanding

·         Intercultural understanding

These general capabilities can be understood as the “new basics”: a foundation for success in learning and in life or fundamental life skills.

These capabilities are not the only general capabilities that might be usefully cultivated in schools. For example, leadership and entrepreneurship may be seen as crucial capabilities for success in the 21st century. Holistic thinking – understanding how the whole influences and shapes the parts – is a vital capability to meet the ecological challenges of the 21st century.

# Definitions and caveats

## Capability

### For the purposes of this paper, I adopt the American Philosopher, Martha Nussbaum’s definition of *capability* as “the ability to perform functions that are necessary for a good life” (e.g. Nussbaum 1995 p. 80). Thus understood, capabilities involve or require knowledge, understanding, values and skills.

## General capabilities

General capabilities are distinct from capabilities specific to a particular discipline. The capability to play a flute is specific to the discipline of music. Critical and creative thinking is necessary to mastery of many disciplines.

## Key Competencies

General capabilities are distinct from key competencies. Key competencies were defined in the Mayer Report as competencies essential for effective participation in the emerging patterns of work and organisation. They focus on the capacity to apply knowledge and skills in an integrated way in work situations.

# How are the general capabilities inter-related?

The general capabilities are deeply interrelated.

*Critical thinking* underpins *literacy and numeracy*. At their higher levels, literacy and numeracy require critical thinking (McCurry 2013 p. 3). An important component of literacy is to write papers with well-structured arguments, and analyse the arguments presented in other texts (Nussbaum 2010 p. 55). Understanding numerical concepts, and exercising numeracy, requires the ability to reason.

An emphasis on *critical thinking* can integrate cognitive development with *personal and social* development (McCurry 2013 p. 3). Lipman argues that caring and critical thinking complement each other. Our emotions shape and direct our thought, provide them with a framework, a sense of proportion, with a perspective, or better still, with a number of different perspectives (Lipman 2004 p. 128).

Positive emotions enhance learning. Students learn more successfully when they have positive beliefs about and evidence of success in their own learning, as occurs when there is an emphasis on and visibility of the *progress* learners are making over time (Masters 2013 p. 24)

Amartya Sen observes reason and emotion play complementary roles in human reflection (Sen 2009 p. 39). There is no irreducible conflict between reason and emotion (Sen 2009 p. xvii). If we are strongly moved by some particular emotion there is good reason to ask what that tells us. Reason does not exclude taking note of the value of instinctive reactions, nor ignore the informative role that our mental reactions often play. And all this is quite consistent with not giving our unscrutinised instincts an unconditional final say (Sen 2009 p. 51).

*Critical and creative thinking* is necessary to *ethical understanding*. Ethical thinking and understanding can be seen as critical and creative thinking applied to Socrates’ question “How should we live?”

According to Sen, underlying his idea of justice (and democracy) is an *open* impartiality invoking a wide variety of views and outlooks based on diverse experiences from far and near, including the points of view of individuals not impacted by the institutions. Sen suggests that if public discussion is confined to a particular locality, there is a danger of ignoring or neglecting many challenging counter-arguments that might not have come up in local political debates but which are worth considering in an impartial perspective (Sen 2009 p. 407). If so, *intercultural understanding informs critical thinking*.

Hassim suggests that *intercultural understanding* consists of three components: recognising culture and developing respect; interacting and empathising with others; reflecting on intercultural experiences and taking responsibility (Hassim 2013 p. 13). The concepts of ‘respect’ ‘empathising’ and ‘taking responsibility’ are ethical notions and so relate to *ethical understanding*.

Hassim identifies several ways of looking at *intercultural understanding* through language. Intercultural communication is about ‘the ability to communicate effectively and appropriately with people from different cultures – and is characterised by *interpersonal skills, team effectiveness*, cultural uncertainty and cultural empathy” – all personal and social capabilities. Intercultural language learning relates to developing a better understanding of their **own** language(s) - so contributes to *literacy*.

Intercultural understanding is a fundamental component of ‘diversity competence’ the ability to manage and negotiate differences caused by race, ethnicity, language, culture, world view and so on. Related key dispositions include critical and creative thinking. Hassim claims that “To specify intercultural understanding as a capability on its own, and not a subset of interpersonal skills or personal and social capability is significant. Often people see intercultural understanding as about interpersonal skills and communication. It is more than that” (Hassim 2013). It is more than *personal and social capability*, but it is partly that.

# How are the general capabilities best cultivated?

The OECD states that to improve learning in school classrooms (not specifically general capabilities), policies need to ensure that schools promote the use of a balanced combination of student-centred instruction with aligned curricular and assessment practices.

The OECD recommends that b*oth direct and student-oriented instruction methods should be used*. Direct instruction is built around problems with clear, correct answers that can be learned quickly. Student-centred instruction is associated with the teacher facilitating students’ own inquiry by allowing them time to find solutions to problems on their own before the teacher demonstrates how a problem is solved. The OECD observes that while there is no consensus in the literature on which approach is better, *an over-reliance on either approach is not recommended* (OECD 2012 p138).

Ken Rowe comes to a similar conclusion. He writes “It is important to note that the relative utility of *direct instruction* and *constructivist* approaches to teaching and learning are neither mutually exclusive nor independent. Both approaches have merit in their own right, provided that students have the basic knowledge and skills (best provided initially by *direct instruction*) beforeengagement in ‘rich’ *constructivist* learning activities. The problem arises when *inquiry-based*, *constructivist* learning activities precede explicit teaching, or replace it, with the assumption that students have adequate knowledge and skills to efficiently and effectively engage with *constructivist* learning activities designed to generate new learning.” (Rowe 2006)

General capabilities, too, are best cultivated through the adoption of a range of pedagogies. We will now describe these pedagogies.

## Direct Instruction

### Presenting

Glyn Davis, former Vice Chancellor, Melbourne University, Victoria, Australia notes that “Much basic teaching [in universities] is still done through lectures, that traditional if not always effective ways to speak to large groups of students – lecture from *lectus,* the act of reading.” Davis notes that the best teachers typically do not read aloud from notes. They profess, stimulate, provoke and respond to student interest (Davis 2010 p. 37)

Good lectures can *model* general capabilities. For example, a lecture might model critical thinking by having a clear and logical structure. A lecture can also *demonstrate* critical thinking by clearly and explicitly identifying a position, reasons for and against the position and principles pertinent to the argument.

### Worked examples

A worked example is a step-by-step demonstration of how to do something, such as solve a problem or, more specifically, a statement of a problem and the appropriate steps to solve that problem.

### Process worksheets

A related way of guiding instruction is the use of process worksheets or an electronic form of process scaffolding. Such worksheets or scaffolds provide a description of the phases required when solving a problem as well as hints that may facilitate completion of each phase. Students typically make use of the process worksheet or process scaffold while they are working on the learning tasks and they may use it to observe the intermediate results of the problem-solving process.

### Personalised direct instruction

According to Michael Fullan “Quality instruction requires getting a small number of practices right. These practices involve knowing clearly and specifically what each student can and cannot do, followed by tailored intervention that engages students in that particular learning in question, and then doing the assessment-instruction-correction process on a continuous basis.” (Fullan 2010 p. 6).

## Inquiry-based pedagogies

### Socratic Pedagogy

Lipman developed and refined a dialogue-based inquiry approach to teaching critical thinking called *Philosophy for Children* – a paradigm example of Socratic pedagogy. The approach is based on a ‘community of inquiry’ in which students listen to one another with respect, build on one another’s ideas, challenge one another to supply reasons for otherwise unsupported opinions, assist each other in drawing inferences from what has been said, and seek to identify one another’s assumptions (Lipman 2003 p. 20).

Linda Darling-Hammond suggests that such an approach is used in teaching mathematics in countries like Japan and China. Teachers pose a single well-chosen problem to students, which students reason through together. Students individually and as a group develop and present a variety of possible solutions for class discussion and further evaluation until everyone understands the concept from multiple perspectives. At the end of this process, the students may derive a formula or set of principles to characterise what they have learned (Darling-Hammond 2011 page 13).

### Progressive inquiry

Progressive inquiry promotes processes of developing knowledge that are characteristic of scientific inquiry. It guides students to generate their own research questions and theories to search for explanations.

A process of inquiry can be divided into different phases.

1. Creating context for a project to help students understand why the issues in question are important. They then commit to answering the questions under investigation.
2. Set up questions that guide the process of inquiry – especially those that arise from the students’ own interest. Questions should seek explanations rather than facts to achieve deeper understanding. By creating a working theory of their own, students can systematically use their background knowledge and make inferences to extend their understanding.
3. Searching and sharing new information. This helps students to become aware of their inadequate presuppositions or background information. This phase requires students to comment on each other’s notes and encourages collaboration.
4. Students focus on improving their theory by generating and setting up subordinate questions leading towards deepening the process of inquiry (Jarvela 2006).

### Problem-Based and Project-Based Learning

Problem-Based Learning also seeks to cultivate learner’s reasoning capabilities. Lessons typically involve the following steps.

1. Students are presented with a problem. The problem should be clear but practical, reflecting the complex, ill-defined, and messy nature of real-world dilemmas e.g. climate change. The problem will generally be multi-disciplinary and incomplete in the sense of lacking information needed for its resolution.
2. Students discuss the problem in a small group. They collaborate in investigating:

* What they think they already know
* What they need to find out
* How they will proceed to investigate the questions
* What they are learning
* How and where they can apply the results of their investigations

1. Students engage in independent investigation of what they need to know outside the collaboration. They may draw on multiple sources of information for this – books, the internet, conversations.
2. They come back to the collaboration sharing information and working together on the problem.
3. They present and discuss their solution to the problem.
4. They review what they have learnt from working on the problem (Barrell 2010).

Progressive inquiry seeks to simulate the collaborative learning and reasoning of scientific theoreticians.

Problem-Based Learning seeks to simulate the collaborative learning and reasoning of the company board room, the Cabinet, or a science laboratory, as they attempt to address complex practical problems and dilemmas, such as the complexities of energy production, sustainable development, providing equitable health care and education, and a fair judicial system.

Project-Based Learning seeks to simulate the collaborative learning and reasoning of designers of artefacts such as a computer animation piece, a play, a multimedia presentation or a poem.

Socratic Pedagogy seeks to simulate the collaborative reasoning of the parliament or parliamentary committee, or of a philosophical dialogue thoroughly examining the pros and the cons of a position, or perhaps public reasoning more generally.

Each of these pedagogies is part of a family of inquiry-based pedagogies. One is no better than any other but they may be used in different contexts to cultivate general capabilities.

# Kirschner’s critique of inquiry-based pedagogies

Some extremists challenge the effectiveness of any pedagogies other than those that involve direct instructional guidance. Paul Kirschner, John Sweller and Richard Clark (Kirschner et al 2006) argue that research on chess expertise has found that expert problem solvers derive their skill by drawing on the extensive experience stored in their long-term memory and then quickly select and apply the best procedures for solving problems (Kirschner et al 2006 p.76). They argue that “Based on our current knowledge of human cognitive architecture, minimally guided instruction is likely to be ineffective…. Minimally guided instruction appears to proceed with no reference to the characteristics of working memory, long-term memory, or the intricate relations between them.” (Kirschner et al 2006 p. 76).

Even if one accepts Kirschner’s and his colleagues’ theory of human cognitive architecture, this does not support the effectiveness of direct instructional guidance in all learning. For example, developing expertise in chess (to choose Kirschner’s and his colleagues’ example) does not typically involve direct instructional guidance. Beyond learning the rules of chess, expertise in chess requires playing lots of games and studying the (sometimes annotated) games of experts. Expertise in chess these days admittedly involves learning a lot of opening theory, which again generally involves the study of games, but that is seldom mediated by direct instruction. It may benefit from studying worked examples, and from coaching, but this involves the study of games or stages of games.

Kirschner and his colleagues state that a “worked example constitutes the epitome of strongly guided instruction… The worked-example effect occurs when learners required to solve problems perform worse on subsequent test problems than learners who study the equivalent worked examples. Accordingly, the worked-example effect, which has been replicated a number of times, provides some of the strongest evidence for the superiority of directly guided instruction over minimal guidance.” (Kirschner et al 2006 p.80).

Supposing that Kirschner and his colleagues are right about the worked example effect, it may be all very well to come up with a worked example in solving a problem in algebra, but quite a different matter to come up with a worked example of a solution to a philosophical problem, or even a mathematical paradox, such as one of Zeno’s paradoxes, relating to the infinite divisibility of a finite line or a finite stretch of time. A worked example of a solution to Zeno’s paradoxes is not really feasible since there is no agreed solution to these paradoxes. Nonetheless, studying Zeno’s paradoxes and investigating various solutions to them can provide valuable insights into the nature of mathematics, space and time and the relationship between these.

Direct instructional guidance, such as following a worked example, may be a useful way to learn mathematics or more aptly, numeracy, but more limited as a way of learning to ride a bike, play chess *well*, play cricket *well*, interpret or write poetry, write well, think well or live well. Direct instructional guidance is fine for learning to solve problems with a clear, definitive solution, but may not be the best way to learn to solve philosophical problems or problems that are complex, ill-defined, and messy – such as the real-world dilemmas that are the subject of investigation in Problem-Based Learning.

Kirschner et al argues that “Stronger evidence from well-designed, controlled experimental studies supports direct instructional guidance. When students learn science in classrooms with pure-discovery methods and minimal feedback, they often become lost and frustrated, and their confusion can lead to misconceptions.” (Kirschner et al p. 79). Socratic pedagogies may not involve direct instructional guidance but it certainly *does* involve students receiving extensive feedback and guidance from their teacher and particularly other students. The direct instructional guidance versus minimal feedback contrast is a false dichotomy.

Kirschner and his colleagues appear to be asking the wrong question. They ask “which is better, direct instructional guidance or minimal guidance in teaching people an activity?” A more appropriate question might be “How do people learn (or develop expertise in) an activity? How can teachers best facilitate this learning?”

Generally speaking, people learn an activity by doing that activity. Sometimes direct instructional guidance will help people learn that activity. Sometimes it may be less helpful. It depends on the activity. Where an activity involves solving problems with one right answer and one tried and true way of reaching that answer, direct instructional guidance may be the best way to facilitate learning in that activity. But where there is no agreed solution to a problem, where the problem is complex and messy, and there is no generally accepted algorithm for solving that problem, perhaps a less direct approach is called for, such as philosophical dialogue or problem-based learning.

# Lipman’s (qualified) defence of inquiry-based pedagogies

Lipman argues that there is nothing wrong with attempting to remodel lesson plans (in an explicit and direct way) so as to make them more likely to encourage critical reflection and to strengthen judgement within and among the disciplines. But, he suggests, these efforts will only be successful if students are permitted to examine directly and for themselves the standards, criteria, concepts and values that are needed to evaluate whatever it is they are talking and thinking about.

Lipman does not argue that direct instruction has no place in teaching and learning. He writes that “It is not that the lecture is an inferior or obsolete mode of pedagogy. It can be brilliant; it can be a work of art; it can often penetrate deeper into its subject matter from its single point of view than can a discussion from its multiple points of view. But to the extent that it is fascinating and charismatic, it turns listeners into passive admirers rather than active inquirers. Too often it inhibits rather than encourages creativity and the same is even true of critical thinking. It appropriates the means of intellectual production instead of turning them over to the students so as to enable them to become productive themselves.” (Lipman 2003 p. 57) If Lipman is right, didactic pedagogies have a place in teaching generally, and in cultivating the general capabilities. *They should not, however, be relied on too heavily*.

We learn general capabilities by doing them - or through practising them. It is arguable that exploratory reasoning can only be practised socially, just as the personal and social capabilities can only be practised socially. In his recent book *The Righteous Mind,* Moral Psychologist Jonathan Haidt suggests that it is very hard “to teach students to look on the other side [of an argument], to look for evidence against their favoured view”. He goes further to say “nobody has found a way to do it.” ([Haidt, 2012, pp. 104-105](#_ENREF_8)). This is because reasoning has “evolved not to help us find truth but to help us engage in arguments, persuasion and manipulation in the context of discussions with other people.” ([Haidt, 2012, p. 104](#_ENREF_8)). However, Haidt does make an important caveat to this bleak assessment of our reasoning capabilities. He writes “We should not expect individuals to produce good, open-minded, truth-seeking reasoning… But if you put individuals together in the right way, such that some individuals can use their reasoning powers to disconfirm the claims of other, and all individuals feel some common bond or shared fate that allows them to interact civilly, you can create a group that ends up producing good reasoning as an emergent property of the social system.” Haidt has succinctly described a Community of Inquiry – an key element of inquiry-based pedagogies. So truth-seeking reasoning can be taught using inquiry-based pedagogies in a Community of Inquiry ([Haidt, 2012, p. 104](#_ENREF_8)).

Having said this, Socratic Pedagogy and other inquiry-based pedagogies could be supported by the explicit teaching of logic, perhaps as part of Mathematics. Through worked examples, students could learn to identify, in a variety of texts, conclusions of arguments and the premises supporting those conclusions. Students could learn different ways of evaluating arguments, again through worked examples, and to distinguish between the validity of an argument (an argument is valid where its conclusion is entailed by its premises) and the soundness of an argument (an argument is sound if it is valid and its premises are true). Students could learn to identify patterns of valid arguments.

Inquiry-based pedagogies are conducive to the cultivation of a range of general capabilities including:

* Critical and creative thinking
* Personal and social capabilities – listening respectfully, not interrupting etc
* Ethical understanding – cultivating better judgement on Ethical issues –
* Intercultural understanding – if there are individuals of diverse cultural backgrounds in the Community of Inquiry.

Carl Berieter and Marlene Scardamalia (2008) suggest that among the more plausible arguments in defence of increasing student agency (through inquiry-based pedagogies) are claims that it develops general capabilities. Berieter and Scardamalia suggest that “Although there is some supportive evidence, the whole idea of learnable mental traits that will generalise to an indefinitely large range of situations is doubtful on both theoretical and empirical grounds” (Berieter and Scardamalia 2008 p 73). Common claims that such-and-such activity “teaches” critical thinking, creativity, collaboration can be probably safely discarded as groundless.

However, Berieter and Scardamalia go on to stress the importance of “knowledge literacy” – understanding the nature of knowledge and how it is produced, how progress in science and other disciplines is achieved (Berieter and Scardamalia 2008 p 75). These are key epistemological - more broadly philosophical - issues applicable to each of the disciplines. Philosophical thinking (a form of critical and creative thinking) appears, then, to be a learnable mental trait that will generalise across a range of disciplines. So is ethical understanding – that also involves philosophical thinking as applied to how we should live.

# How are the general capabilities best assessed?

Masters (2013) specifies five design principles underpinning a Learning Assessment System.

**Principle 1:** *Assessments should be guided by, and address, an empirically based understanding of the relevant learning domain*.

The monitoring of learning progress requires deep familiarity with the terrain through which learners are progressing.

**Principle 2:** *Assessment methods should be selected for their ability to provide useful information about where students are in their learning within the domain.*

Different assessment methods, including electronic assessments, paper and pen tasks, student performances, research projects, products of art and technology and portfolios of student work are likely to be valid for different kinds of learning.

**Principle 3:** *Responses to, or performances on, assessment tasks should be recorded using one or more task ‘rubrics’.*

Each task rubric consists of two or more ordered levels or response to a task. Task rubrics provide the direct substantive link to the larger learning domain. Through their ordered levels of response/performance, they operationalise what it means to make progress within the domain.

**Principle 4:** *Available assessment evidence should be used to draw a conclusion about where learners are in their progress within the learning domain.*

This conclusion, which is the purpose of the assessment process, always involves an interpretation of the available assessment evidence. It is an inference based on recorded task performances. In educational contexts, individual assessment tasks are convenient and interchangeable vehicles for gathering evidence and drawing conclusions about where learners are in their learning within the domain of interest.

**Principle 5:** *Feedback and reports of assessments should show where learners are in their learning at the time of assessment and, ideally, what progress they have made over time* (Master 2013 pp. 7-8)*.*

Each of these principles can usefully be applied to effective assessment of general capabilities.

# ECD approach

## The Evidence Centred Design (ECD) approach expands on Masters’ fourth principle. ECD is a systematic approach to designing assessment that uses the idea of constructing an evidentiary argument to make a claim about a student’s knowledge, skills and abilities. The approach is useful in the assessment of general capabilities in several ways.

## Through Domain Analysis, ECD provides a means to identify the important things to be assessing in each domain. This involves gathering substantive information about the area to be assessed, including specific concepts, how knowledge is constructed, how it is acquired, how it is used, and modes of communication that are valued within that domain.

ECD tools such as Design Patterns are a way to map the assessment space, which includes all decisions an assessment designer can make about the item or test being developed. This form of design decision-making makes the evidentiary argument explicit because assessment design choices follow a consistent structure, such as that provided by Design Patterns. Therefore, ECD supports a principled approach to assessment design by providing a set of categories that are consistent across design patterns of different domains.

Most importantly for General Capabilities, Design Patterns can be written to be content-neutral, so that a design pattern on critical and creative thinking can be applied to different content areas that might require such thinking, such as biology, earth sciences and economics. As such, ECD has the potential to provide an integrated approach to assessment across subjects.

# SOLO Model

General capabilities may be best assessed using *assessment for learning*.

The Structure of the Observed Learning Outcome (SOLO) taxonomy, (Biggs 1995, Biggs and Collis 1982) provides a systematic way of describing how a learner’s performance grows in complexity when mastering varied tasks. Accordingly, SOLO reflects the five principles identified by Masters. The SOLO taxonomy postulates five levels of increasing complexity in growth or development of concepts or skills:

Prestructural The task is engaged, but the learner is distracted or misled by an *irrelevant* aspect belonging to a previous stage or mode

Unistructural The learner focuses on the *relevant* domain and *picks up one aspect* to work with

Multistructural The learner *picks up more and more* relevant and correct features, but does not integrate them

Relational The learner now *integrates* the parts with each other, so that the whole has a coherent structure and meaning

Extended abstract The learner now *generalises* the structures to take in new and more abstract features, representing a new and higher mode of operation (Biggs and Collis 1991 page 65)

Implicit in the SOLO model is a set of criteria for evaluating the quality of a response to (or outcome of) a task utilising general capabilities. The quality (or richness or complexity) of a response to a complex task varies with the *relevance* of the considerations brought to bear on the task, the range or *plurality* of those considerations, and the extent to which these considerations are *integrated* into a whole, and *generalised* to or related to, broader contexts.

The following reasoning progression based on a framework proposed by Songer (2009) captures critical thinking using the SOLO taxonomy. The levels are as follows.

|  |  |
| --- | --- |
| **SOLO Level** | **Critical thinking progression** |
| *Pre-structural* | Student makes a claim. |
| *Uni-Structural* | Student makes a claim and gives a reason for that claim. |
| *Multi-Structural* | Student makes a claim and provides a range of (unrelated) reasons supporting that claim. |
| *Relational* | Student makes a claim, develops a valid argument for the claim, identifies objections and counter-arguments to the claim and replies to those objections and counter-arguments |
| *Extended Abstract* | Student makes a claim, develops a valid argument for the claim, identifies objections and counter-arguments to the claim and replies to those objections and counter-arguments, articulates and tests general principles supporting the claim. |

A teacher using the SOLO framework for assessing an argument proposed by a student might seek evidence of:

* Reasons advanced in support of a claim – are they relevant to that claim?
* The range of reasons advanced in support of a claim – are a range of relevant issues considered?
* The integration of relevant considerations into a valid argument – does the student develop a valid argument for the claim, identify objections and counter-arguments to the claim and reply to those arguments?
* The application and testing of principles – does the student identify a general principle in support of a claim, and test that principle?

The SOLO model can be used with particularly good effect in connection a student-centred pedagogy – such as Socratic Pedagogy.

SOLO can be used to assess group and individual performance.

# ACARA’s Continua

ACARA has developed continua for each of the general capabilities. These are divided into six levels under each element of the capability in question. The levels are age, or more specifically, Stage based.

Level 1: Typically by the end of Foundation Year, students…

Level 2: Typically by the end of Year 2, students…

Level 3: Typically by the end of Year 4, students…

Level 4: Typically by the end of Year 6, students…

Level 5: Typically by the end of Year 8, students…

Level 6: Typically by the end of Year 10, students…

These phrases are followed by statements of what students are able to do, such as pose questions.

A limitation of this approach is that it is age-based or stage-based. At the heart of the Masters’ (2013) proposals for assessment reform is *a shift away from an age-based, lock-step process* of classroom activity, towards one focused on the developmental needs of each student derived from evidence-gathering and observation with respect to empirically based learning progressions. ACARA’s approach appears inconsistent with the approach proposed by Masters.

As Masters notes, it is not the case that all learners progress sequentially through a set of hierarchically organised levels. “Individuals develop along idiosyncratic learning paths. Some may never show evidence of a particular way of thinking. Others may appear to regress in their understanding before developing higher levels of conceptual understanding.” (Master 2013 p. 20)

By contrast, SOLO is not age-based or lock-step.

# How might curriculum best support the cultivation of the general capabilities?

Hassim (2013) suggests that “Criticisms have been made in some quarters of the Australian Curriculum as being too content based. If you think it is, then my message is that the general capabilities are there to come to the rescue.” (Hassim 2013 p. 14). Specifying general capabilities in the curriculum is necessary to support the cultivation of these capabilities. It is not, however, sufficient support.

Curriculum specifications in syllabus documents can influence the types of pedagogies adopted by teachers. For example, giving too much emphasis to propositional knowledge (knowing that...) in a syllabus over skills or capabilities (knowing how...), or specifying too much content (propositional knowledge) in syllabus documents can result in pressuring teachers to rely on didactic pedagogies to deliver that content. We have seen that critical thinking is best cultivated through using a combination of direct instruction and inquiry-based pedagogies. Inquiry-based approaches seem useful in developing general capabilities since they engage students in practicing the capability. While in many English speaking nations there is a well-established division of labour between curriculum developers and teachers that curriculum authorities make decisions about what is in the curriculum and teachers make decisions about how to teach it, *curriculum developers need to be mindful of the influence on pedagogy that curriculum might have*. Care needs to be taken with the amount of content specified in syllabus documents. There are political pressures to include too much content in syllabus documents, since it is considered that to say that particular content should not be included in the curriculum is to suggest that it is not important.

Is it feasible to reduce the content specified in curriculum without compromising quality of education?

Joanne Capper suggests that curriculum should focus on central ideas, and aim for deep understanding of central ideas rather than wide coverage of topics. Greater emphasis should be placed upon concepts as well as facts. Students should learn key concepts, concepts should be interrelated, and relations should be established between old and new knowledge (McCurry 2013 p. 10). Costa advocates the selection of relevant, generative and wondrous content to serve as the vehicle for learning (McCurry 2013 p. 12).

One way of reducing content and at the same time to support the cultivation of critical thinking is to give greater emphasis to what Lipman calls *essentially contestable concepts*—concepts that lie at the heart of any discipline when it is presented as a living thing rather than simply as a body of established knowledge. This suggests that one way of animating the disciplines with the spirit of inquiry is by attention to the philosophically problematic within them. Lipman argues that if thinking in the classroom is considered desirable, the curriculum should not present itself as clear and settled, for this paralyses thought. The curriculum should give greater emphasis than it does at present to aspects of the subject matter that are unsettled and problematic in order to capture the laggard attention of the student and to stimulate them to form a community of inquiry (Lipman 2003 page 20).

Attending to the philosophically problematic within a discipline is one way of reducing the content in curriculum – making it less crowded, and at the same time generating or cultivating thinking capabilities.

A related approach is suggested by Geoff Masters. He suggests that most curriculum and syllabus development activities are located somewhere on a continuum representing varying degrees of research input. At one extreme are curricula that simply specify in a top-down way a body of content that students are to learn, with little or no input from research into how students learn that content. At the other extreme, but rare in practice, are curricula that are strongly grounded in domain-specific learning research (Masters 2013 p.33).

Research in cognitive psychology and education reveals that learning is a personal, active, constructive, rational process. Through research in psychology and education, we now know that young children are capable of much more sophisticated reasoning than was once thought possible (Masters 2013 p.17). Studies of novices and experts in a range of areas of expertise show that experts have deep and extensive knowledge of their subject matter. The extensive knowledge of experts is organised around important concepts, principles and big ideas in their areas of expertise, giving them deep understandings of their subjects (Masters 2013 p.18). Masters suggests that curriculum strongly grounded in domain-specific learning research *would be organised around important concepts, principles and big ideas,* rather than being a catalogue of desirable outcomes, overcrowded with relatively superficial factual and procedural content.

# Should the general capabilities be a “add on” to the curriculum or integrated within the disciplines?

It is sometimes suggested that inquiry-based pedagogies require an integrated curriculum rather than a subject based curriculum. An integrated curriculum may have certain advantages over a subject-based curriculum in terms of encouraging learners to make connections across disciplinary boundaries. However, general capabilities can be learned *within* disciples as well as across disciplines. Critical thinking, holistic thinking, creativity and imagination can be learned in the context of a wide range of disciplines.

# How can emphasis on the general capabilities best be used to integrate the curriculum?

We have seen that general capabilities are those capabilities that are not specific to a discipline. For example, critical and creative thinking is a capability that is not specific to a discipline but is employed across a range of disciplines.

Masters (2013) claims that in practice much curriculum planning is not based on solid empirical evidence about typical sequences and progressions of learning, but is driven more by conventions and beliefs about what should be taught in particular years of school. When curriculum design is informed by a *developmental* perspective, the curriculum provides a frame of reference for planning and monitoring the development of more sophisticated understandings, higher levels of knowledge, more advanced thinking, improved communication skills, increased abilities to analyse and interpret information, and so on.

It is possible to develop sequences or progressions of learning for the general capabilities, for example, using the SOLO model. By foregrounding the general capabilities it is possible to design tasks that draw on content from a range of disciplines, and, because of the inter-related nature of the general capabilities, are likely to cultivate and assess a range of capabilities.

For example, a task using Socratic Pedagogy to identify and evaluate arguments for and against live animal exports will involve the development of a range of general capabilities including critical and creative thinking (identifying and evaluating arguments), ethical understanding (relationship between human and animal interests), intercultural understanding (requirements relating to halal) and personal and social capabilities (respectful listening, identifying emotional reactions towards live animal exports). The task may draw on content from a range of disciplines including Religious Studies (practices surrounding halal) Economics (a comparison of costs of live animal exports compared to alternatives) Ethics (how do animal interests relate to human interests, and harm to animals of live exports compared to alternatives) Biology (e.g. evolutionary bases of halal) Legal Studies (why did New Zealand ban live animal exports?).

ECD has been described in relation to assessment design. In addition, the principled design approach could also inform curriculum, particularly the integration of curriculum. This could be accomplished through the appropriation of some categories of design patterns written for the assessment of the general capabilities. Since design patterns are written to be content-neutral, the same design pattern has the potential to be applied to different content areas. This would enable, for example, a design pattern on critical and creative thinking to be applied to both English, perhaps in the analysis and writing of texts, as well as Science, in interpreting data and designing experiments.

There are several design pattern categories that could be used in this way. *Focal Knowledge Skills and Abilities* could be used to identify the high-level learning goals of the activity which should then be applied to the content area. *Additional Knowledge Skills and Abilities* and *Variable Features* could work together to identify additional demands placed on the student which are not the focus of the activity and the corresponding features of the work which operationalise or remove these demands. The *Characteristic Features* category could identify characteristics that should be present in all activities that are designed from the same design pattern, and *Potential Work Products* would describe the output that could be expected from activities based on that design pattern.

# How can the general capabilities be used to differentiate/ personalise learning?

Masters re-centres the discussion about assessment on current understanding of how students learn, and how their knowledge and understanding grows. His simple unifying principle is: *The fundamental purpose of assessment is to establish where learners are in their learning at the time of assessment.* The principle is in line with a broader move towards recognising that education is about personal learning.

The SOLO framework can be adopted to establish where learners are in their learning (uni-structural; multi-structural; relational or extended abstract) for a particular capability. This understanding can be used to identify how a learner might move to the next stage of learning.

A pedagogy can be conceived of as a particular combination of labour between teachers, learners and technology. Knowledge (including know-how) is a synergistic effect of this combination of labour. Consider a pedagogy of Direct Instruction. Van den Broek defines *Direct Instruction as “*a teaching program intended to improve and accelerate learning by means of clear and concise direct communication by the teacher and high rates of student success during extensive guided, sequenced practice.” (Van de Broek 2012 p. 17) Direct instruction involves a combination of labour between teachers and students. The teacher provides clear and concise direct communication, a clear sequencing of content and guidance. Students, for their part, *listen* to the communication by the teacher, *remember* the content of what is communicated, and *practice* what they have learned.

Compare Direct Instruction with Learning-by-Design. Van den Broek characterises *Learning-by-design* as “an inquiry-based science learning program with a focus on learning for flexible transfer to new situations. Students work on a design challenge (*e.g.*, a self-powered vehicle, an artificial lung, or a locker-organizer) that requires some critical knowledge or skills to be learnt (*e.g.*, Newton’s laws of motion, the anatomy of the respiratory system).” (Van den Broek 2012 p.10). Teachers *plan* the activity, identifying the kinds of reflection that most likely enable the students to remember concepts and skills and enable the students to transfer concepts and skills to new problems. For their part, students are expected “to make connections with prior knowledge, ask questions, identify relevant knowledge, and discover and practice new scientific concepts.” Students design technology, using technology.

Inquiry-based pedagogies, and tasks designed to cultivate and assess general capabilities, tend to combine the labour of participants in such a way that gives learners more discretion about what they contribute to the task – depending on their interests. Thus they are intrinsically more personalised compared with pedagogies designed to cultivate the memorisation of content.

Extended response tasks are tasks that provide opportunities for students to develop and to demonstrate their integrated knowledge, understanding and capabilities from various areas of the curriculum. Extended response tasks cultivate and assess the ability to make judgements and think critically and creatively. These tasks often contain internal structure, or scaffolding, to encourage students to attempt the task – access points to assist students to engage in inquiry.

Inquiry based pedagogies also allow for greater differentiation of curriculum than more didactic pedagogies, since there is greater scope to allow students to direct their inquiries in areas of interest to them, within the framework of the larger, collective inquiry. (DEC 2013)

Whilst not a pedagogical approach ECD can provide guidance in the design of a differentiated curriculum by through the use of the *Additional Knowledge Skills and Abilities* category. This category specifies additional or assumed knowledge, skills and abilities which are not the target of the assessment (or in the case of curriculum, the activity) but which may be required for a student to complete the work successfully. Differentiation can take the form of selecting which of these to support for some students, and building that support into activities for those students.

# What are the implications of general capabilities for teacher learning?

If future learners are to develop capabilities to think well and live well, their teachers will need to think well and live well too – at very least to model general capabilities. This has implications for teacher education, as Phillip Cam explains.

“It is essential for teachers to become familiar with an inquiry-based approach to the subject matters that they teach if they are going to promote thinking in the classroom. Given this, the general lack of such an approach in the formation of teachers provides a great hurdle standing in the way of reflective education. This must change. Experience has shown that the success rate in converting classrooms into communities of inquiry is quite low when established teachers are introduced to such ideas by way of a professional development day or through in-service courses of a few days’ duration. That is only to be expected.... The future of reflective education very much depends upon some serious reconstruction of pre-service training.” (Cam 2006)

Teachers are not going to be able to cultivate general capabilities that they do not have themselves. Thus to better cultivate the general capabilities, teacher educators will need to adopt the same approaches to cultivating and assessing general capabilities in teachers that are necessary to cultivate general capabilities in school students – including the wider adoption of inquiry based approaches, such as Socratic Pedagogies.

# CONCLUSION

Knowing how and knowing that are distinct, but inter-related ways of knowing.

Accordingly different approaches are needed to learn how and learn that and teach how and teach that.

The general capabilities are best cultivated using a broad tool kit of pedagogies. It would not be wise to rely too heavily on any one pedagogy or type of pedagogy. However, because of the differences between knowing-how and knowing-that, cultivating general capabilities requires more emphasis on inquiry based approaches.

Learning and assessment tasks need to be designed in such a way as to immerse the learner in the activity we are seeking to cultivate, and provide feedback about the learner’s achievement.

To encourage the cultivation of general capabilities curriculum needs to focus more on capabilities and less on content. Emphasis should be on the contentious, since this encourages thought. Curriculum design needs to be informed by a *developmental* perspective, and provide a frame of reference for planning and monitoring the development of more sophisticated understandings, higher levels of knowledge, more advanced thinking, improved communication skills, increased abilities to analyse and interpret information.

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