EDUCATION: FUTURE FRONTIERS

OCCASIONAL PAPER SERIES

On critical thinking and collaborative inquiry

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An essay commissioned by the NSW Department of Education

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EDUCATION: FUTURE FRONTIERS is an initiative of the NSW Department of Education exploring the implications of developments in AI and automation for education. As part of the Education: Future Frontiers Occasional Paper series, the Department has commissioned essays by distinguished authors to stimulate debate and discussion about AI, education and 21st century skill needs. The views expressed in these essays are solely those of the authors.

Across the globe in recent years, calls have been growing for education to renew its focus on higher-order skills and capabilities – often referred to as '21st century skills' – in order to better prepare young people for an increasingly complex world. While there is no agreement on exactly what 21st century skills should comprise, there are some commonalities, including the ability to think critically and work with others to approach complex problems in novel ways. Though these skills are by no means new, many believe that they are becoming ever more important for all young people to acquire in order to thrive in a world increasingly globalised and augmented by technology. There are, therefore, more frequent calls for students to have stronger capacities in critical and analytical thinking so that they might identify biases in news, data and in their own interpretations, develop deeper understanding of complex ideas and empathy for different perspectives. But what do we mean by critical thinking and how do we teach for thinking, not just for learning?

Critical thinking has become ubiquitous among lists of educational outcomes at all levels. Primary, secondary and tertiary educational institutions, as well as many of the courses and subjects they offer, explicitly state the desirability of developing critical thinking skills. Employers, too, strongly value critical thinking as an attribute in prospective employees. It is hardly surprising therefore that critical thinking is well-recognised as a key 21st century skill.

What is surprising, however, is the lack of clarity behind what we mean by 'critical thinking'. Do we mean a list of skills, a set of dispositions, a familiarity with logical thinking, a willingness to engage, expertise in inquiry, well-honed inferential thinking, an understanding of thinking norms or all the above? Even if critical thinking can be clearly articulated along these lines, the pedagogical imperatives that can lead us to these outcomes are not always obvious. Nor are the kinds of professional development that can build critical thinking capabilities in employees easily envisaged or implemented.

In this paper, I intend to articulate some of the assumptions that often underlie calls for critical thinking in education, as well as some assumptions that do not but perhaps should. These assumptions concern the nature of critical thinking, its position with respect to discipline knowledge, the contexts in which it is best taught, what can be said about critical thinkers as well as critical thinking, and what teachers need to know and do to effectively teach critical thinking—including some implications for assessment. In considering these issues, I will also consider how we might go about integrating much of what we know about critical thinking and about effective teaching for thinking in general.

What do we *mean* by critical thinking?

It is generally true that no-one laments their own lack of thinking skills. While it is easy for people to admit to a lack of proficiency in mathematics, languages or technology, say, or to readily acknowledge a poor memory, no-one says 'please don't try and reason with me, I'm just too irrational'. What's more, most of us like to think we are the exemplar of the rational person—with the implication that if only more people could think like us and see the world as we do we'd all be better off. This means that our conception of what critical thinking is can be biased towards the way we already think. This nearly universal phenomenon of promoting the efficacy of our own cognitive performance helps to explain why everyone

seems to value critical thinking and perceives a deficit of it around them.

Identifying what we mean by critical thinking, in other words how we use the term, would seem to give us our best shot at understanding its nature. Unfortunately, many of those who claim to value critical thinking are hard pressed to explain exactly what they mean by it beyond typically diffuse references to 'higher-order thinking' or general reasoning characteristics. Other phrases, such as 'analytical thinking' and 'scientific reasoning' are well enough defined, but their relationship to critical thinking—i.e. whether they may be constituents of critical thinking or otherwise conceptually bound to it—is not clear. For a more objective idea of critical thinking, we must turn to the literature. But here, too, there is no uniform understanding or acceptance. Definitions vary from the ability to correctly assess statements (Ennis, 1964), examine and evaluate our own thinking with regard to criteria and standards (Elder and Paul, 2013), or to be 'appropriately moved by reasons' (Siegel, 1998, p. 23).

Even so, we might discern resemblances between definitions. One thing they have in common is a commitment to processes of evaluation and justification grounded in some kind of attempt at rational objectivity. The use of the words 'correctly', 'criteria' and 'appropriately' in the definitions suggest an appeal to normativity, however that normativity might be arrived at. Note also that these definitions move from the clinical 'correctly assess' to the clearly passionate 'moved'. This reflects a common blurring of the line between critical thinking and critical thinkers. Such a merging between the act and the actor is not unexpected as it must be a person doing the thinking. However, it might pay a dividend in terms of our pedagogical focus if we can meaningfully talk separately, at least at some points, about thinking skills and thinking virtues (i.e. the characteristics of people who think) as we progress.

MANY OF THOSE WHO CLAIM TO VALUE CRITICAL THINKING ARE HARD PRESSED TO EXPLAIN EXACTLY WHAT THEY MEAN BY IT BEYOND TYPICALLY DIFFUSE REFERENCES TO 'HIGHER-ORDER THINKING' OR GENERAL REASONING CHARACTERISTICS

Others have attempted to deliver a higher resolution in terms of what it means to think critically. The American Philosophical Association's Delphi Report (1990) produced a consensus view on critical thinking that outlined a set of definitive skills and dispositions around critical thinking, including detailed descriptions of subskills, definitions, examples and educational imperatives (if not pedagogical direction).

In less depth, but with more attention to skill development, the Australian Curriculum's Critical and Creative Thinking General Capability also teases apart 'key ideas' of critical thinking (noting, quite properly, the essential relationship with creative thinking). More recently, the Queensland Curriculum and Assessment Authority (2015) synthesised a range of Australian and international reports on the skills needed by individuals for success in the 21st century including the 'associated skills' of critical

thinking such as analytical thinking, problem-solving and decision-making. But let me move away from attempts to define critical thinking with such operational precision and talk more of its nature.

What makes a critical thinker

One aspect of critical thinking that is often not explicit in the literature is that it begins with understanding our own thinking. It is hard to reconcile a paradigmatic critical thinker characterised by having insight into the minds of others with someone being blind to a lack of rigour in their own reasoning. This experiential aspect of critical thinking, that it is first and foremost about our own thinking, means that certain elements of knowing how to think are non-propositional knowledge (Ellerton, 2015). Non-propositional knowledge is knowledge which cannot be transmitted by language alone. More specifically, it is not contained in propositions. For example, I cannot teach someone how to surf by simply speaking to them. At some stage, they must get on the board and find out for themselves what it's like.

Gilbert Ryle (1970) captured the difference between these two types of knowledge, knowledge that can be transmitted through language alone and knowledge that cannot, as the difference between knowing *that* and knowing *how*. I know *that* gravity, my sense of balance and the force I exert on a bicycle pedal are factors at play when it comes to making a bicycle go forwards while I remain upright, but that does not mean I know *how* to ride a bike. In the same way, knowing how to think is more than a consequence of being told what to think, or even how to think (to whatever extent that is possible). The fact that thinking has this experiential flavour carries with it the pedagogical implications common to all experiential, non-propositional, knowledge: what can we get people to *do* that improves their practice?

ONE ASPECT OF CRITICAL THINKING THAT IS OFTEN NOT EXPLICIT IN THE LITERATURE IS THAT IT BEGINS WITH UNDERSTANDING OUR OWN THINKING

Thinking as inquiry

Before we can address what we might do to improve our capacity to think critically, we need to be a little more specific about what we mean by 'thinking'. Following the American pragmatists Charles Sanders Peirce and John Dewey, we can make a meaningful equivalence between thinking and inquiry. Peirce understood inquiry as axiomatic for progressing reason (and progressing through reason). What he calls the corollary to his rule of reason—'that in order to learn you must desire to learn, and in so desiring not be satisfied with what you are already inclined to think'—is: 'Do not block the way of inquiry' (cited in Haack, 2014, p.319). But what can we understand by 'inquiry' that would show it to be as important as Peirce suggests? Peirce saw that thinking could 'never be made to direct itself toward anything but the production of belief' and that beliefs themselves were things achieved to soothe 'the irritation of doubt' and become in fullness 'a rule of action' and 'a new starting-place for thought' (Peirce, 1878).

In the pragmatic tradition established by Peirce and carried through by Dewey, William James, Matthew Lipman and others, inquiry is the process of moving from doubt to belief. But simply moving from doubt

to belief need not involve thinking of the sort we see as educationally valuable. The missing element that moves us from thinking as simple reaction or association into the kind of thinking marked by improvement through education is what Dewey calls reflective thinking, an 'active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends' (Dewey, 1910, eBook: Chapter One). Lipman makes a link between inquiry and such reflective practice in an understanding of inquiry that goes beyond the broad sense Dewey gives us:

> By 'inquiry' I mean self-correcting practice. I do not call a behavior inquiry if it is merely customary, conventional, or traditional—that is, simply practice. But if the supervening practice of self-correction is added to that practice, the result is inquiry. (Lipman, 2003, p.178).

The 'practice of self-correction' is a reflective practice. We might call reflective thinking a necessary condition for 'critical' thinking on the assumption that reflection alone is insufficient without some necessary recourse to standards and criteria that determine how improvement in practice might occur. If we accept this, then we see the logic of Dewey's comment that: 'The essence of critical thinking is suspended judgment [as we experience doubt and look to fix beliefs]; and the essence of this suspense is inquiry to determine the nature of the problem before proceeding to attempts at its solution' (Dewey, 1910, eBook: Chapter Six).

The type of inquiry we engage in with students to improve their thinking, therefore, is that inquiry which requires reflective thinking. But more than this, thinking for inquiry must take us into the 'self-correction' of Lipman's account and so to the means by which this correction is guided. On this understanding of the relationship between thinking and inquiry we can also accept quite specific definitions of inquiry, such as requiring 'comparative evaluation of competing arguments with the goal of making reasoned judgments' (Bailin and Battersby, 2015, p.123), as derived from the general conditions of inquiry outlined above.

But if we are to value inquiry, we must value doubt, for doubt is the beginning of inquiry. This has certain implications for our classrooms, as Lipman points out:

> If, then, thinking in the classroom is considered desirable, the curriculum cannot present itself as clear and settled, for this paralyses thought. (Lipman, 2003, p. 21)

Lipman means that, for a thinking education, the classroom cannot simply be seen as a medium for the smooth transmission of knowledge from teacher to student. Classrooms in which things are 'settled and clear' imply an absence of doubt, hence an absence of inquiry, hence an absence of opportunities to engage in reflective thinking, and hence an absence of opportunities to improve thinking.

That all classrooms are not inquiry focussed is not surprising, given an understanding of how modern schools developed. Modern educational systems, beginning in the early 19th century, were subject to pressures of numbers and an increasing recognition that classical methods and topics of education were slow and unproductive. Jeremy Bentham's *Chrestomathia* school, developed for the growing middle classes and designed to address the need for faster and more immediately useful educational outcomes, is paradigmatic of the view that education

is for utility, and a largely scientific utility at that (Bentham, 1816). Both critics and supporters of Bentham acknowledged that schools were to be modelled on factory processes, and this was something of a selling point for many; but not for all. Elissa Itzkin (1978) notes correspondence from a school of the time expressing concerns that the roles of students and masters are too rigorously defined within this model.

> Indeed, the duties of each must be made perfectly mechanical. There must be no doubt or hesitation on the part of the master or pupil; for doubt would produce delay and dispute, and consequently throw the whole machine into disorder. Hence there can be no appeal to the reasoning powers; for reasoning, never can be reduced to mechanism . . . every boy must conform to the average motion of the School.

and

> It is our object to produce voluntary mental exertion; and we therefore cannot think it judicious to subject our pupils to continual restraint. We wish to teach them to educate themselves, while we direct their operations. We must teach them to think as well as act; while all that is attempted in favour of the others is to teach them the latter power. (Itzkin, 1978, pp.313–314).

This seems to me an exquisite articulation of the conflict between the need for teaching for thinking and the constraints of a manufactory model of education, showing how the diminishing of inquiry equates to a lack of thinking focus.

The skills of critical thinking, however they may be articulated in detail, can therefore be thought of as the thinking skills that support effective inquiry. This framing still leaves much work to be done, but at least it provides a link between thinking and classroom practice (that thinking begins with inquiry) that can act as a starting point.

Critical thinking and discipline knowledge

It's often said of critical thinking that you have to be thinking about something. Some authors (e.g. Willingham, 2008) point out that the more you understand the knowledge of your domain, the more sophisticated your thinking can be, and that without such complexity, learning to think well is problematic. While this may be true, it does not imply that the skills we bring to bear on complex problems cannot be talked about, practised at some level, and become themselves objects of study with a view to improving them as we move through to a deeper understanding of our domain knowledge.

The critical thinking skills of which we can speak are legion and include the already mentioned problem-solving and decision-making, but also the ability to see patterns, discern meaning, detect inferential errors and other fallacious reasoning, generate and test ideas, apply criteria effectively, imagine alternatives, justify preferencing one course of action of another and so on. Lipman knew how daunting a task capturing these thinking skills would be, noting that 'the list is endless, because it consists of nothing less than an inventory of the intellectual powers of humankind' (Lipman, 2003, p.8). While all of this, and much more, might be representative of the skills of thinking well, simply generating a list of desirable characteristics does not provide pedagogical direction. The educational focus is not sharp enough to show us how to achieve these ends. To move

towards a practical understanding of what we can do, and get students to do, to improve thinking, let me now consider in more detail the relationship between content and thinking.

The most basic thing we can ask students to do with knowledge is to recall it. (We might argue that we first wish them to remember it, but let me group these two skills for simplicity's sake). This is a necessary, but low-level requirement of learning—we might, more aspirationally, want students to also understand that which they can recall. So how do we ourselves understand what 'understand' means?

One way to explain 'understanding' concerns how knowledge is organised and structured in our minds. If I ask you to remember a list of phone numbers, it would not seem sensible to ask if you understood the list. It is a list of numbers, granted, but beyond that minimal understanding it seems a shallow task. Each element of that list has very little connection with the other elements. Contrast this with asking you to commit to memory a food web in which predator and prey species were intimately involved with each other's business of survival. What I would be looking for is an indication that you have not only recalled the elements of the web, but also the nature of their relationships and interactions. In other words, I would ask that you understood what it was that you reproduced. More than this, I would expect that knowing the relationships between the elements makes learning each one of the elements easier than it would be if they were in isolation from the others. Therefore, 'information that needs to be "understood", rather than merely learned, consists of material that has a high degree of element interactivity' (Sweller, 1994, p.311). The logical implication of this understanding is that learning experiences intended to improve student understanding are those that make the nature and relationship between elements of the concept, object, construct or system to be understood clear.

Knowledge organised into coherent frameworks in which elements and their relationships are contained in mental models is called schematic knowledge, and the structures themselves are called schemata. In teaching for understanding, therefore, our business is the development of organised schematic knowledge in students' minds. While this endeavour is clearly one associated with content knowledge, how is it related to thinking?

There are two important considerations here, the understanding of which deliver pedagogical insights. The first is that the more effectively our knowledge of our domain is organised, the better we can make use of it to solve problems. So, to improve students' abilities to make decisions and solve problems within a domain, we must improve their schematic knowledge of that domain (a necessary but not sufficient condition).

The second consideration is that schematic knowledge, once properly formed, does not require the use of working memory to access and use it. Individual elements not organised into a schema each need a slot in working memory, and each has a life measured in seconds unless actively renewed. Schematic knowledge is not only free of the constraint of working memory, but the sum of that knowledge within the schema is also available. These two considerations mean that thinking with schematic knowledge is fast, effective and effortless in comparison with thinking using large amounts of unorganised knowledge.[1] Expert diagnosticians thinking schematically can reach diagnoses much quicker than novices and with error rates up to

[1] It is the freedom from reliance on working memory that distinguishes between what has been called System One and System Two thinking (see Kahneman, 2011).

five times less (Harasym et al., 2008). Indeed, it is characteristic of expert behaviour that their knowledge is so structured and used (Glaser et al., 1988).

Cognitive skills can support the process of developing deeper understanding and mastery of content knowledge

Understanding is a thing to be attained, or perhaps extended or used to build further understanding. It is not of itself a skill. But there are skills that do directly relate to thinking and can themselves contribute to the broader skills such as problem solving and decision making, as well as to developing understanding. These are known as cognitive skills and they already populate our syllabuses, work programs and assessment tasks. They are skills such as analyse, evaluate, justify, synthesise, organise, identify, infer, categorise, hypothesise and so on. They are also known as cognitive verbs (Marzano, 2006) and hence describe things that we *do*. As to what we do them *with*, the answer is our brains (or, more appropriately, our minds). As to what we do them ***to***, one useful answer is content knowledge, including knowledge of situations, circumstances, contexts and requirements.

The cognitive skills constitute, in large part, what we do when we are thinking, at least at a descriptive if not neurological level. While they might not be constituted by matching cognitive processes (e.g. there might not be a part of our brain or a particular process generally associated with 'analysing') they provide a shorthand way to talk about what we mean by thinking in an educational context, as well as providing a mechanism for delivering a measurable output. The results of a text analysis can be written down. The justification for a claim can be articulated. The criteria for evaluation can be discussed. The organisation of knowledge can be displayed.

In these ways thinking, or at least the outputs of it, can be made clear. To make the thinking clear, the process by which the student uses these skills to progress through the task can be talked about, critiqued and fed back upon. It is easy to see that the quality of an analysis, the strength of a justification, the confidence of an evaluation or the sophistication of a synthesis can be improved by a deeper understanding of domain knowledge. But, as I pointed out earlier, this does not negate discussing the skills with a view to understanding their nature and purpose. Let me provide an example.

The skill of analysis might be broadly understood as looking at some object or construct to discern its function or purpose. It might include identifying the elements that make up the construct or object, how they are related to one another, whether they may exist in certain categories, and how they contribute to the purpose or function of the whole, including investigating which elements are more relevant or significant than others and why this may or may not be the case, and perhaps also to seek for patterns or hidden structures.

Whether this is an agreeable definition or not is not so important; the point is rather what we might do with such a definition to help students understand analysis. Having developed a satisfactory shared understanding of what analysis is, students can recognise what is being asked of them when a task sheet requires them to analyse something. Students know to look for function, to identify elements, to categorise if possible, to seek relevance and significance, to look for patterns and so on. How well they do these things is, partly, a function of domain

knowledge, but critically it is also the very skill we are seeking to develop through practice, feedback and reflection on the level of success reached. Framing and explaining analysis in this way is not a magic bullet to achieve high level analysis, it is rather a means of providing clear learning experiences designed explicitly to improve analysis by providing opportunities for students to use those skills and to receive feedback on them. In other words, to improve their thinking.

ONE WAY TO ADDRESS THE ISSUE OF THE RELATIONSHIP BETWEEN CRITICAL THINKING AND DISCIPLINE KNOWLEDGE, IS TO CLAIM INDEPENDENCE FOR THE UNDERSTANDING OF THINKING SKILLS BUT DEPENDENCE FOR THEIR DEVELOPMENT TO HIGH LEVELS

While these questions of analysis are generic and broadly describe what we ask students to do in applying the skill, the answers to them are context and hence discipline-specific. One way to address the issue of the relationship between critical thinking and discipline knowledge, therefore, is to claim independence for the understanding of thinking skills but dependence for their development to high levels. This is because such high-level thinking requires a full and complex understanding which presumably is more attainable within a discipline context than through general knowledge.

Critical thinking, education, philosophy and collaborative inquiry

In looking at initial definitions of critical thinking, I noted their appeal to some kinds of normative standards of thinking. That there are norms of thinking is not hard to accept—after all, thinking is not an 'anything goes' affair. What those norms are and how they are—or ought to be—derived are questions with complex answers. And they are important answers since thinking, like a language, cannot be learned in isolation and the way in which these norms are understood and put into practice determines in large part the kind of thinker a person will become. When learning a language, our skills develop fastest and most fully when we have a chance to speak to another person who also has some understanding of that language. It is only by getting feedback from them that we can determine the success or otherwise of our efforts to communicate with them through that language. If we mispronounce a word so that its meaning is lost to the listener, or if our grammar is so distorted that either meaning is lost or an incorrect interpretation of what we are saying is made, then we have opportunities to correct what we are doing in the full knowledge of what has gone wrong and how we can best correct it. Without such interaction, growth in our competency is difficult.

There are parallels here with learning how to reason well. If our arguments are unclear, if we do not express all the assumptions we hold that lead us to a conclusion, or if our conclusions are the result of webs of beliefs that are not shared by others, we might fail to be persuasive to others. More than this, we know that the bar for convincing ourselves that something we wish to be true is in fact much lower than the bar for other people who are not so motivated (see, for example, Strickland et al., 2012). We must learn that

the sincerity of our beliefs, or the volume or frequency with which we express them, are not necessarily effective as persuasive techniques. The respect and care we develop for epistemic rigour and rational engagement is born from our experiences with others, not from the introspections of our own minds alone in *a priori* fashion.

THINKING WELL IS ALSO ABOUT LEARNING HOW TO THINK *WITH* OTHERS, TO IN EFFECT BECOME PART OF A BROADER SOCIAL COGNITION THAT CAN ACHIEVE MORE COLLECTIVELY THAN IS POSSIBLE INDIVIDUALLY

Thinking well is, in part, a result of our experiences of what others find persuasive and why, as well as reflection upon our own thinking to produce such persuasive effects. But thinking well is also about learning how to think *with* others, to in effect become part of a broader social cognition that can achieve more collectively than is possible individually. Furthermore, an education in thinking must also move to the normative question of how we ought to think, and this takes us to philosophy.

> The notions of 'reason' and 'rationality' [...] are philosophically problematic. Just what is a reason? How do we know that some consideration constitutes a reason for believing or doing something? How do we evaluate the strength or merit of reasons? What is it for a belief or action to be justified? What is the relationship between justification and truth? Why is rationality to be valued? (Siegel, 1989, p.127)

Because these issues are at the core of how we understand what makes for good reasons and for good reasoning, 'it is central to critical thinking education that students be given some understanding of the epistemology underlying critical thinking' (p. 127).

An exemplar of collaborative inquiry with a view to establishing norms of effective thinking is the Philosophy for Children (P4C) program, developed initially by Matthew Lipman and Anne Sharp, which has established itself as a successful program for the teaching of thinking skills (Lipman, 2010, 2003, 1998; Lipman and Sharp, 1978; Splitter and Sharp, 1995). Bearing the legacy of Peirce and Dewey in terms of epistemological assumptions and educational applications, and incorporating the pedagogical imperatives of Vygotsky, P4C has developed as an established educational practice in many countries, including Australia (Burgh and Thornton, 2016). The efficacy of this approach in terms of cognitive gain for students is backed by research over a number of years (see, for example, Gorard et al., 2015; Millett and Tapper, 2011; Topping and Trickey, 2007).

Splitter and Sharp recognised that in identifying thinking that is educationally worthwhile we are talking about more than simple cognition, we are also concerned about the norms of thinking.

> It is this normative dimension that marks our inquiry as philosophical rather than empirical; as being concerned with how young people ought to think rather than merely with how they think. (Splitter and Sharp, 1995, p.7)

Considering 'how young people ought to think' could be misinterpreted as a call for uniformity of thought, but it is rather a call for an integrated and systematic understanding of thinking in terms of

standards, criteria and its effectiveness in inquiry. This indeed was Lipman's educational goal, to 'build a system of thought' for students (Lipman, 2003, p.103). Lipman focused on several aspects of thinking and also recognised that when we talk about thinking we are talking about both thinking and thinkers; hence he was concerned with both thinking skills and the development of dispositions. Most importantly, he considered that this was best achieved through a pedagogical approach based on the community of inquiry, in which norms of thinking could be collaboratively developed and reflectively refined and in which key concepts such as justification and reasoning could be located in discourse rather than in individuals. Thus, for Lipman, the 'normative' aspect of thinking was one derived from engagement in collaborative inquiry. Philosophy was not the content of the classroom, but the methodology of teaching based on inquiry, argumentation, and collaborative development of the norms of rational thinking.

The community of inquiry is also the source of inquiry values, identifying what is valuable in the act of inquiry and therefore in the act of thinking (Ellerton, 2016). Understanding what we value in thinking gives us a means to evaluate thinking. These values and their application are a significant aspect of the norms of thinking, and include clarity, precision, plausibility, significance, breadth, depth and simplicity. They have been recognised as values by Thomas Kuhn (1970), by Lipman himself (2003) and a subset of them structured more formally by Elder and Paul as Intellectual Standards (2013).

In the environment of collaborative inquiry, speaking of cognitive skills and giving feedback using what we value in thinking gives us a language in which to practise and promote metacognition and in which to help students understand how the values should be applied in the practice of inquiry.

CONSIDERING 'HOW YOUNG PEOPLE OUGHT TO THINK' COULD BE MISINTERPRETED AS A CALL FOR UNIFORMITY OF THOUGHT, BUT IT IS RATHER A CALL FOR AN INTEGRATED AND SYSTEMATIC UNDERSTANDING OF THINKING IN TERMS OF STANDARDS, CRITERIA AND ITS EFFECTIVENESS IN INQUIRY

Critical thinking, logical reasoning and argumentation

The fashioning and evaluation of arguments is fundamental to our idea of reasoning and of critical thought, in as much as the critical aspect is analytical and evaluative. Argumentation is in a sense the framework in which critical thinking can effectively occur. Argumentation is a large part of the methodology of philosophy, but also of rational inquiry in general. Not only does it have a formal beginning in the logic of Aristotle, but Dan Sperber and Hugo Mercier even suggest that our capacity to reason has evolved 'to produce arguments in order to convince others and to evaluate arguments others use in order to convince us' (2012, p.2). It would therefore be remiss in the context of this paper to discuss critical

thinking without considering how it is related to argumentation, or how argumentation can be used to develop students' critical thinking capabilities.

In considering argumentation, it is necessary to first define what an 'argument' is. To argue is to engage in an intellectual process. While there are many ways to talk about it, there seems no great need to move beyond the definition offered by Monty Python[2] as 'a connected series of statements intended to establish a proposition' (2014). More formally, an argument is made up of premises, those things we take to be true for the purposes of the argument, and a conclusion, the point at which we arrive after duly considering the premises and inferring to our final proposition. Arguments allow us to contextualise reasoning (Battersby and Bailin, 2011) and provide a structured platform for engaging with issues in a rational way. Arguments demand of us the direct application of a range of cognitive skills. They can be identified, interpreted, constructed, and, crucially, evaluated. When we justify a decision or preference, we construct an argument to defend our claim.

Arguments can be evaluated by testing them for two key attributes: validity and soundness. A valid argument is one in which the conclusion is logically and necessarily entailed by the premises. A sound argument is a valid argument with true premises. We understand someone's claims as an argument which can be assessed on the likelihood of the premises being true and on the strength of the logical pathway from the premises to the conclusion.

Arguments

Arguments are formal structures that outline how new beliefs (conclusions) are justified on the basis of existing beliefs (premises).

The process of drawing a conclusion from a series of established premises is technically known as 'inferring'. When we infer, we either attempt to reach a conclusion that is necessarily true given the truth of a set of premises (deduction) or, at the least, to reach a conclusion that is coherent with a set of premises (induction).

Arguments help us to contextualise our reasoning and hence apply it in real-world situations. The construction, analysis and evaluation of arguments requires that a broad range of thinking skills is brought to bear in a framework that provides a focus for cognition and a direction for progress. Argumentation, therefore, is an essential component of teaching for thinking.

THROUGH ARGUMENTATION STUDENTS CAN LEARN HOW TO THINK PHILOSOPHICALLY AND BE SELF-REFLECTIVE ABOUT THEIR OWN THINKING AND ASSUMPTIONS

Constructing arguments, therefore, provides a mechanism for discussion, analysis and evaluation of claims that allows for a high inferential resolution and hence increased potential for rational rejection or acceptance of claims.

[2] See also the Argument Clinic sketch www.youtube.com/watch?v=0rTEzYbMiNM

Moreover, it is in the acts of arguing, or explicitly evaluating arguments or justifying positions through constructing arguments, that cognitive and other social interactions between students can occur that deliver the opportunities for testing ideas and establishing norms. In other words, through argumentation students can learn how to think philosophically and be self-reflective about their own thinking and assumptions.

Assessing thinking

Attempts to assess students' thinking are usually focused on one of two broad approaches or a combination of them. The first approach is to determine whether or not students are successful in inferring what statements logically follow from others (and identifying those that do not). This approach requires students to demonstrate an understanding of logical structures, including formal arguments, and to properly navigate through problems with detailed logical and causal connections. Examples of this sort include the well-established California Critical Thinking Skills Test and other tests typically used in pre-post testing to determine the efficacy of critical thinking courses or programs.

The second approach is broader and includes looking at students' work to see if it reflects what they ought to be able do at certain developmental stages, typically focusing on categories of tasks such as 'posing questions', 'generating ideas', 'identifying key concepts', 'metacognition' and so on. This latter approach is that taken in the Australian Curriculum's Critical and Creative Thinking 'Learning Continuum' which considers student growth in thinking abilities over year levels. Let me label these two approaches as the 'structural' and the 'developmental' approaches respectively.

One might also expect students' results in structural tests to improve in the very short term following explicit instruction in, and repeated examples of, structural thinking. One might also expect students' results in structural tests to improve over the longer term even without explicit training in logical structures. As students age and as they engage with increasingly complex subject matter they develop better cognitive resources and more experiences that encourage sophisticated thinking.

Structural approaches run the risk of simply reflecting good teaching rather than deep learning. For example, imagine giving a student a pre-test in their knowledge of chemistry, teaching them some chemistry, and then giving them a post-test. Presumably, some improvement would be noticed, but that does not mean the knowledge gained is transferable or sustainable. Developmental approaches run the risk of being descriptive rather than prescriptive, stating merely what the student should be capable of at a particular stage rather than what we wish for them as a result of targeted improvement. They also run the risk of catering to a 'lowest common factor' paradigm, as they typically deal with age-level groupings.

Cognitive verbs can also act as a focus for the assessment of thinking, with the advantage of being discipline-centred as required. The ability of a student to perform in questions of analysis, evaluation or justification, for example, can be measured and used to assess thinking. Of course, this approach runs the risk of ignoring issues of depth and breadth of content knowledge that can impact these results, but it is not difficult to craft questions that emphasise cognition using elementary subject matter and so exercise some control over this variable.

Whatever method or combination of methods might be used to test student thinking, and whatever their disadvantages might be, we are not left without options.

Concluding thoughts

Powell and Snellman speak of the 'knowledge economy', in which 'the key component [...] is a greater reliance on intellectual capabilities than on physical inputs or natural resources' (2004, p.199). Economies are not defined by what they disseminate, distribute or consume alone, however; these are simply derivative of what the economy produces. A 'knowledge economy' therefore not only disseminates, distributes and consumes knowledge, it produces it. We have a word that describes the production of knowledge: it is 'thinking'. Thinking, or inquiring, produces new knowledge, and teaching thinking, or teaching inquiry, helps develop the knowledge producers of the future.

Understanding what is effective about inquiry tells us what is effective in thinking, and this is something that each area of inquiry, or discipline, can understand and frame for itself considering the nature of its domain knowledge and methodology of inquiry. But there are general aspects of inquiry that speak to the cognitive behaviour of inquirers.

One general aspect is the use of cognitive skills, which, while used to build understanding and to use that understanding to solve problems within discipline areas, have an architecture that can be spoken of independently of those areas. A knowledge of cognitive skills and their development can give us guidance in designing and constructing learning experiences and assessment items to ensure their practice and improvement. Those learning experiences will only improve the cognitive skills of students, however, if students are provided with timely and effective feedback that identifies and promotes what it is we value in the act of thinking and inquiry. What we value in thinking, and how we apply those values, is best learned and constructed collaboratively to allow students an opportunity to internalise individually what has been learned socially. Social cognition not only allows for this formative phase of learning the norms of effective thinking, but also enhances our ability to overcome limitations in individual thinking such as cognitive biases and framing problems (Mercier and Sperber, 2011).

The task of identifying the norms of thinking, and understanding how are they developed, is a philosophical one. The nature of reasoning, what makes for good reasons and why ought we to be moved by reasons, lie at the heart of the project of teaching critical thinking. Philosophy programs in schools such as P4C are often representative of critical thinking in education (without being exhaustive).[3] It is the (self-reflecting) methodology of philosophy, not necessarily its content, that provides the pedagogical focus on inquiry that emphasises thinking skills and the nature of reasoning.

As teachers of thinking, we wish for students to not only think about philosophical (and particularly epistemological) issues, but also to think philosophically. Part of this methodology is argumentation, which both contextualises thinking and provides a structure for the analysis and evaluation of our thinking. Argumentation is not so much the point of critical thinking as it is the framework in which it can most effectively occur. Useful knowledge about thinking that is often present in 'critical thinking' programs—for example knowledge of the fallacies of reasoning,

[3] Other examples of philosophy in schools include the Queensland senior subject Philosophy and Reason and The Western Australia subject Philosophy and Ethics.

cognitive biases, belief formation and motivated thinking—are less the substance of thinking as they are functional decorations to be placed on the tree of argumentation.

Philosophy for Children

Philosophy for Children (P4C) has been a significant presence in educating for thinking for several decades. Developed in the US by Matthew Lipman and Ann Sharp as a means of focusing on student thinking, it has grown into a world-wide movement deeply embedding the theory and practice of philosophy as a methodology of teaching (rather than philosophy as subject matter).

The community of collaborative philosophical inquiry is at the heart of the P4C pedagogical approach, in which issues relating to the nature of knowledge, meaning and rationality are engaged with and developed through deliberative discourse and reflective thinking.

WE NEED TO FOCUS CLOSELY ON HOW TEACHING FOR THINKING, NOT JUST FOR LEARNING, ALIGNS WITH THE RESOURCES, PROCESSES AND EDUCATIONAL VALUES OF OUR SCHOOLS

The success of P4C in developing students' thinking skills is well established, showing cognitive gains that persist beyond engagement in the classroom. The educational imperatives that emerge from this picture of critical thinking are still being shaped, but they must logically include a focus on inquiry

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(understood as reflective thinking), a commitment to plan and speak in the language of student cognition to enable metacognitive strategies to be enacted and to provide feedback on thinking and a plan to work collaboratively to establish and refine the norms of effective thinking as well as increase the effectiveness of it through social cognition.
For these things to occur, we need to focus closely on how teaching for thinking, not just for learning, aligns with the resources, processes and educational values of our schools and larger organisational structures (including those directed to teacher training). Just as some technologies are seen as disruptive because they do not fit existing business models (Christensen, 1997), the pedagogy of teaching for thinking may also be disruptive in that it is ill-suited to simple didactic models, not well assessed by standard tests, highly collaborative rather than teacher-focussed and concerned with inquiry as much as with content. All these characteristics are anathema to Bentham's factory model of schooling and so, to the extent we have not been able to evolve sufficiently far from that, to current models of schooling.

The utility of teaching for thinking may well be economic, but it is also a social good. Learning to think well is a path to individual resilience, not just intellectual but emotional. It can empower students to deepen their understanding of the world around them and deal with contradictions and uncertainty. Understanding the motivations of those around us and the effect our actions have on each other is a virtue born not only of empathy but of the ability to imagine and engage with the minds of others in a purposeful and rational way. Writ large, this is also a function of good citizenship. Critical thinking is not just the chrome and steel of effective cognition, it is deeply embedded in the circumstances of our humanity. It is a part of our cultural heritage. For all these reasons, we are obliged to make it a priority for our students.

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