

Critical Thinking – a definition and taxonomy for Cambridge Assessment: supporting validity arguments about Critical Thinking assessments administered by Cambridge Assessment.

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Abstract

This research can be seen as an activity in order to contribute towards the validity arguments of assessments. One aspect of validity is that the internal structure of any assessment should be consistent with that of its content domain. However, this notion is predicated upon having some working conception of the construct or content domain. The particular domain in question is that of Critical Thinking.

Despite it being a relatively new subject, Cambridge Assessment now has a history of over two decades of assessing Critical Thinking. Increasingly, Critical Thinking skills are being recognised and valued in educational and work settings, leading to a high demand for tests and assessments to measure and acknowledge these skills. Over time, the range and nature of these assessments have grown and evolved, with an understanding of the construct of Critical Thinking being transmitted implicitly through the coincidence of common personnel involved in the development and item writing. Cambridge Assessment, in order to inspect the construct validity, representativeness and coherence across its Critical Thinking assessments, needed an explicit working conception of the domain of Critical Thinking.

This paper will present the process of deriving a Critical Thinking definition and taxonomy as well as mapping the assessments against it in order to judge the degree of curriculum relevance.

Introduction

Accepting that validity is a unitary concept, though with multiple strands (Messick 1989), this activity, through focusing upon the construct of the domain in question, is one through which to accumulate evidence to support “the adequacy and appropriateness of interpretations and actions based on test scores” (ibid, p42). We wished to elucidate the conception of the nature and structure of a particular domain in order to have an explicit mechanism by which we could judge the fit or relevance of any particular test against the objectives of the domain in question. It is likely that this activity of focusing upon the construct could be applied to assessments in any subject domain in order to support validity arguments. In this particular case, the domain in question is that of Critical Thinking.

Thus, the main aim of this research activity was to create a definition¹ and taxonomy² for Critical Thinking in order to support validity arguments about Critical Thinking tests and exams administered by Cambridge Assessment³.

There are a vast number of Critical Thinking definitions in the literature (e.g. Ennis, 1996; Fisher and Scriven, 1997; Paul, 1992), which are highly varied and often multi-faceted. The construct of Critical Thinking is hotly debated, with a number of key battlegrounds. The implications of such differing conceptions reach out beyond academic journals. They impact upon educationalists in a number of practical ways, such as devising the best training or delivery model for Critical Thinking; designing

¹ Definition: ‘stating the precise nature of a thing’

² Taxonomy: a term, now commonly borrowed from the biological sciences meaning ‘dealing with the description, identification, naming, and classification of organisms’

³ Cambridge Assessment is the parent organisation for three examining bodies: University of Cambridge ESOL Examinations which provides qualifications for learners and teachers of English for Speakers of Other Languages (ESOL), taken by 1.5 million people in 135 countries; OCR, one of the UK’s leading providers of qualifications to learners of all ages through 13,000 schools, colleges and other institutions; Cambridge International Examinations (CIE), the world’s largest provider of international qualifications for 14-19 year olds. CIE qualifications are available in over 150 countries.

and delivering assessments which are authentic and which nurture good Critical Thinking skills in students.

For these reasons, and others listed below, Cambridge Assessment aspired to have a definition of its own:

Cambridge Assessment as the expert

Cambridge Assessment has 20 years of experience in testing Critical Thinking, unrivalled by any other body within the UK. In order to capitalise upon this experience, it seems sensible to have a definition, or clear sense of the construct that we say we are measuring, so we can be sure that our measures are valid and that we are making valid inferences from these assessments.

Coherence

It is important that, across Cambridge Assessment's existent Critical Thinking offerings, there is a coherent understanding of the usage of the term and the construct being measured. This should also be true of any assessments or qualifications developed in the future.

Currently, Cambridge Assessment has five, long term, extant products (see Figure 1): BMAT, TSA, CIE Thinking Skills AS/A level, OCR AS/A Level Critical Thinking and OCR AEA Critical Thinking, all of which share a common ancestor, namely MENO⁴. However, each of them has a slightly different evolutionary history, tests differing aspects and subsets of Critical Thinking, and is used for different purposes and candidate types.

Additionally, there is a newer qualification, namely CIE's H2 Knowledge and Inquiry, which includes a Critical Thinking paper. This is less obviously a descendent of MENO, though it does necessarily involve analysis and evaluation of arguments. Equivalent to A-level, it was developed specifically for Singapore's stronger candidates in order to enhance skills needed for university.

It is hoped that one of the primary functions of this work will be that it can provide a means by which quality assurance of the tests and examinations can take place, which, until now the abstract or 'intangible' nature of the discipline (Ebel, 1965) has made elusive.

New and evolving Critical Thinking assessments

Another pressing need for a definition relates to the fact that nothing stands still in the world of assessment. A number of new Critical Thinking products are in development. The CIE Thinking Skills specification altered its scheme of assessment from summer 2008 and OCR has had a new specification accredited for teaching from September 2008. But more dramatically, a new generation of tests and qualifications is in development. The CIE Pre-U Global Perspectives qualification is one high-profile example. This will be an obligatory unit for those wishing to gain the Pre-U diploma, and contains Critical Thinking elements. Whilst possibly a more applied context than other Cambridge Assessment offerings, this will bring a particularly international dimension to Critical Thinking. CIE is also developing an IGCSE in Global Perspectives, and whilst nothing in the specification is actually called Critical Thinking, there are resonances of Critical Thinking in the pilot specification (e.g. in terms of 'reasoned responses' or 'engaging in enquiry').

Another example is uniTEST, a selection test under development, which is designed to be a general university admissions test with a widening participation agenda. Its Critical Thinking (or Critical Reasoning) items are presented as a middle ground between abilities used in arts/humanities and those used in maths/science.

Finally, OCR is developing a new specification in Thinking Skills as a Level 2 qualification, for 14-16 year olds, with Critical Thinking skills at its core.

It is less obvious exactly how some of the newer products fit into the family tree, and which products are their immediate predecessors. Nonetheless, the developers of many of these new qualifications have also been involved in existent qualifications and so some sort of common understanding of the nature of Critical Thinking is transmitted implicitly. Certainly, it would be preferable from the point of

⁴ MENO is not an acronym – this test was named after one of Plato's students.

view of ensuring validity, for test developers to work with a more explicit and developed conception of the nature and structure of the Critical Thinking domain; and it is this *explicit* construction of the model.

Looking further ahead, it is likely that the number and nature of Cambridge Assessment tests and qualifications will continue to change and evolve and therefore, for the purpose of coherence of new and future products, it is vital that there is a Cambridge Assessment definition of Critical Thinking. Quite possibly, in years to come, any definition may need to be reviewed in the light of the natural evolution and development of the discipline. Nonetheless, a definition would still have a lifespan useful for the guidance for any development work.

Perceptions of Critical Thinking

Perceptions of Critical Thinking are highly varied and not always based on an informed understanding of the identity and nature of Critical Thinking. This is hardly surprising when academic perceptions and definitions are so multitudinous (for a short summary, see Black, 2007), with philosophical definitions at odds with psychological ones, some focussing more upon skills whilst others emphasise dispositions, and so on. There is also much discussion about what *is* versus what *isn't* Critical Thinking. The outer edges or the fringes of the discipline are not always clear, with much variety in terms of exclusivity or inclusivity of definitions.

Certainly, in terms of size of candidate entry, Critical Thinking AS/A level could be said to be 'popular' in schools: it became OCR's biggest AS level in 2005-6⁵, and the fastest growing A level⁶ in the UK in 2007. Within schools, however, teachers hold mixed perceptions of the value of Critical Thinking. At one end of the spectrum some teachers perceive Critical Thinking as the 'holy grail' of education, as vital in developing rational argument and reasoned thinking, whilst at the other end teachers (erroneously) see it as something more akin to common sense or general knowledge. Undoubtedly, there are also a number of teachers who have only superficial acquaintance with the discipline and thus have only a limited idea of what it entails. It is not surprising, therefore, that universities have different policies on the value of Critical Thinking for admissions. For example, some universities do accept Critical Thinking AS/A level as part of their main offer, whereas others look upon it favourably as an additional extra, but will not accept it as part of its main offer.

Still, whatever and however people perceive Critical Thinking, there is evidence that students who take Critical Thinking AS level do better in their other A-levels than those who do not take Critical Thinking (Gill and Black, *in prep*).

Cambridge Assessment, with all of its collective expertise, is in a unique position to respond to the issues identified above through focusing upon the construct in question and therefore contribute to the long-term integrity, coherence and validity of its Critical Thinking products.

⁵ Cambridge Assessment Group Annual report 2005-6 accessed at http://www.cambridgeassessment.org.uk/ca/digitalAssets/110764_Cambridge_Assessment_Group_Annual_Report_2005-2006.pdf on September 12th 2007

⁶ Advanced Level General Certificate of Education (A level GCE) qualifications are perhaps the most popular post-16 educational route in England, Wales and Northern Ireland. They typically require two years of study beyond GCSE, with the first year of work being assessed at Advanced Subsidiary (AS) level.

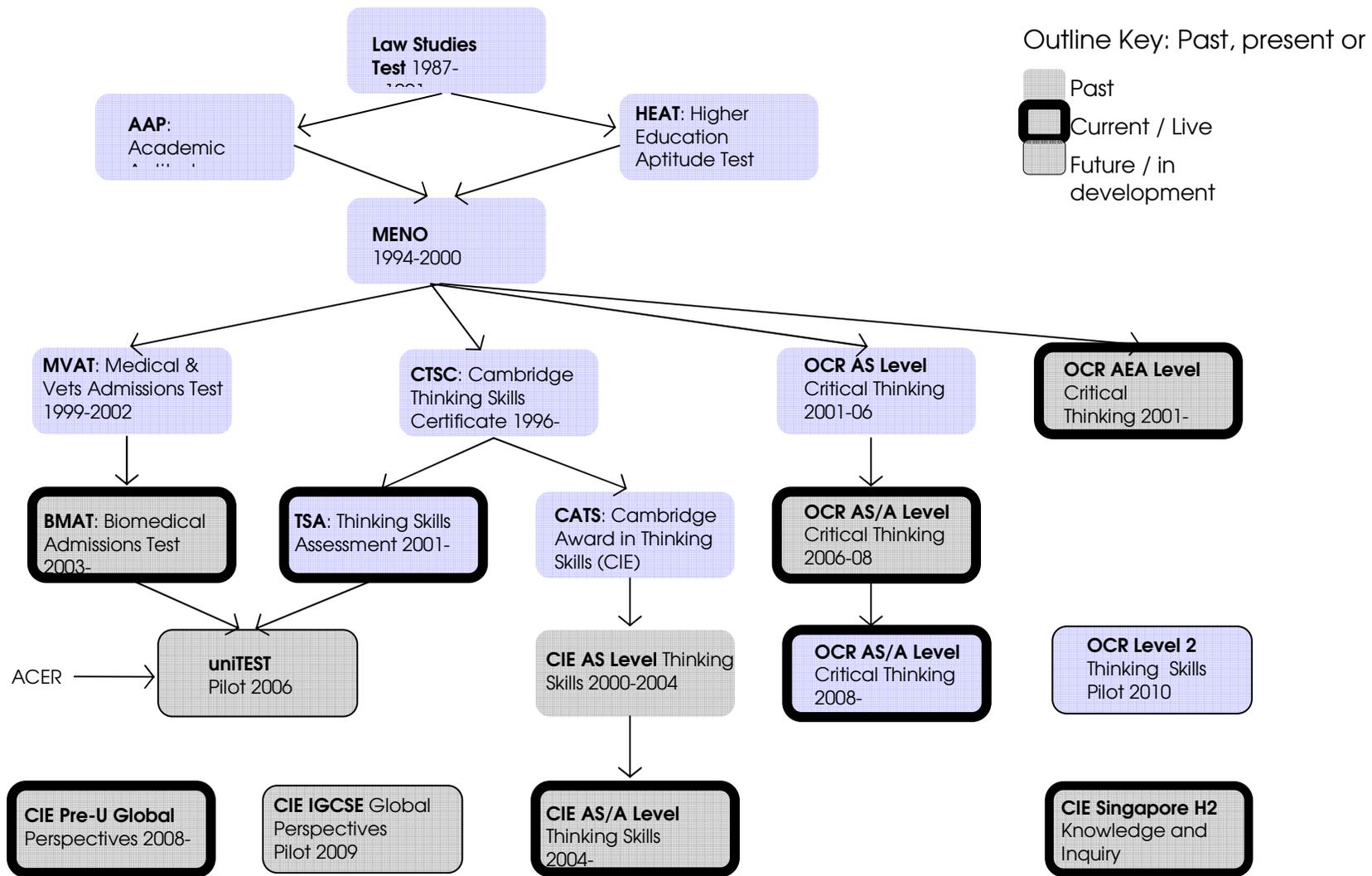


Figure 1: Family Tree of Cambridge Assessment Critical Thinking products

Method

In the first instance, in December 2006, a large one-day meeting was convened, comprising Cambridge Assessment personnel with responsibility for the various Critical Thinking tests and qualifications, as well as a number of Critical Thinking experts who have had involvement with Cambridge Assessment as item writers and/or senior examiners. At this meeting, the topics for a semi-structured discussion included whether a Cambridge Assessment definition and taxonomy for Critical Thinking were desirable and possible. The participants were unanimous in wanting a definition, and broadly consensual regarding the need for a taxonomy. Various existent definitions of Critical Thinking were considered during this meeting.

Overall, the recommendation from the meeting was that a smaller group of three or four experts should be charged with the task of developing both a definition and taxonomy. It is this activity, which took place over four days in October 2007, which forms the basis for this article.

The experts

The expert panel comprised four Critical Thinking experts, all of whom have worked for Cambridge Assessment in examining and/or item writing and/or specification development in this area. They were chosen in consultation with the relevant test administrators with Cambridge Assessment group. The guiding principle in selecting these experts was to have good coverage across existent qualifications and tests, as well as to have a range of experience of Critical Thinking (academic, school teaching etc).

These individuals were chosen also for some specific qualities or experience. For example, one of the panel members is commonly regarded as one of the leading UK Critical Thinking experts. Another expert was chosen not only for Critical Thinking knowledge, but also expertise in Problem Solving, and to aid the panel in its consideration of the 'outer edges' of Critical Thinking, that is, those 'higher-order thinking skills' which are *not* Critical Thinking. Another panel member has been involved with Critical Thinking AS since its beginning, was a member of QCA's⁷ Critical Thinking Advisory Group (which, amongst other things, was responsible for QCA's definition), and has experience of teaching a variety of candidate types (from under-achieving to gifted and talented). The fourth has a background in Philosophy and has established his expertise in Critical Thinking in teaching, item writing and being a senior examiner. Between the four experts chosen, there was an aggregate of 57 years of experience in Critical Thinking and six published books.

Tasks for the four-day meeting and organisation of time

The experts were asked to:

- derive a Critical Thinking definition
- derive a Critical Thinking taxonomy
- as far as possible, map Cambridge Assessment qualifications against the taxonomy
- identify skills closely related to Critical Thinking but which are not considered to be Critical Thinking.

The meeting took place over four consecutive days – October 3rd to October 6th 2007. The beginning of the four days was marked by a one-hour plenary session with the relevant CIE, OCR and Cambridge Assessment representatives in order for them to raise construct and definitional issues pertinent to their particular products.

For the main part of the four days, it was deemed to be more productive to allow the experts to decide how to proceed, while offering them three possible approaches (see figure 2).

The top down approach, working sequentially to derive first a definition as a group, then a taxonomy, followed by the mapping exercise, might be considered the purist's approach, in that the definition is derived before and independent from a consideration of the products. However, an entirely pure approach in this respect may not be achievable: naturally, for the experts, their working knowledge of their products (see Table 1 above) is implicit and bound to inform any work on the definition.

⁷ Qualifications and Curriculum Authority – a governmental organisation which, until early 2008, took the role of the regulator for qualifications taken by candidates in England and Wales.

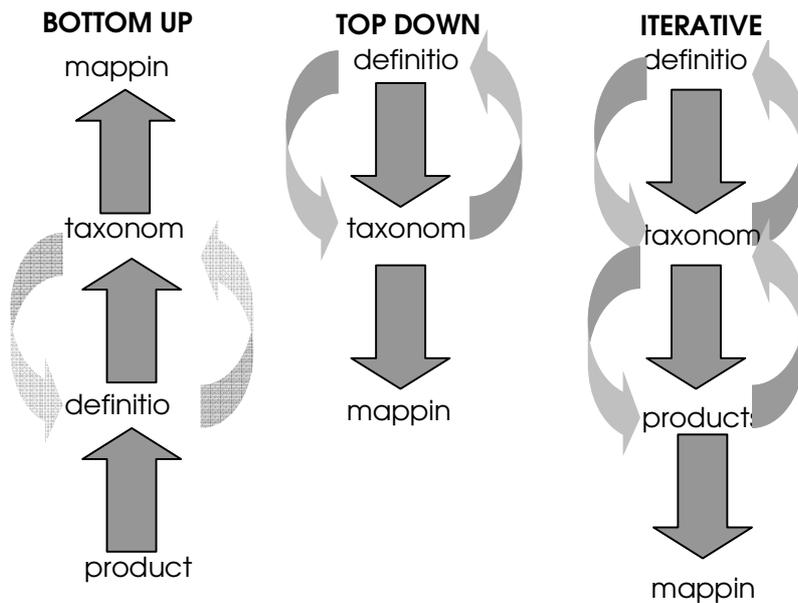


Figure 2: Alternative approaches offered to the panel for the process of determining the definition and taxonomy.

The bottom-up approach involves considering the Cambridge Assessment products in some detail before deriving a definition. In one sense, this would be putting a framework around what we have already got, the products themselves providing the driving force for the activity. In other words, the bottom-up process might result in an overly self-confirmatory definition and taxonomy. However, this approach would have an advantage of ‘reminding’ the panel of (valid) aspects of Critical Thinking.

The iterative approach suggested is based upon the top-down model, where activities logically proceed from the definition. However, this model builds in a capacity to revisit and ultimately refine one step in the light of decisions about another step (as in Figure 2).

Unanimously, the experts chose to adopt the iterative approach. This proved a fruitful approach as, on occasion, the mapping exercise challenged the current version of the taxonomy: for example, the panel questioned whether one sub-skill should be presented as two separate sub-skills, or, conversely, whether two sub-skills were, in reality, inseparable and should be conflated.

There was a range of supporting materials and reference points to draw upon, including many existent Critical Thinking definitions. In particular, experts were guided towards the QCA definition of Critical Thinking (because it was derived in the UK and favoured by the one-day December meeting) and the Facione taxonomy⁸ (1990).

During the course of the meeting, it was also decided that the Cambridge Assessment definition should be accompanied by an explication or rationale. The purpose of this is to explain or clarify the intended meaning or choice of words or emphasis contained within the definition. It captures some of the lengthy consideration around the table during the four days and is really intended as a guide for users of the definition. Similarly, the expansion of the taxonomy is again to provide guidance and clarification.

The panel also mapped all Cambridge Assessment products against the taxonomy. All the assessments were mapped by all four panellists. In order to record their judgements, the panel were provided with a grid whereby the

⁸ Facione’s taxonomy was derived by the Delphi method, along with a definition, using a panel of 46 experts. Undoubtedly, Peter Facione’s ambitious project to arrive at a definition through expert consensus (Facione 1990) was an attempt to achieve greater harmony amongst Critical Thinkers (in North America at least). However, perhaps the main drawbacks of the Facione definition are its length and its over-inclusivity.

taxonomy skills and subskills were listed down the side and the various assessments were listed across the top. Participants were asked to judge, for each assessment which of the skills and subskills in the taxonomy were evident, and whether there were additional skills assessed and/or credited which fell outside the definition and taxonomy. Participants were provided with test / qualification specifications, example exams or tests (usually, the most recent), and where possible, actual examples of student work. Consensus between the judges was achieved through discussion. This part of the activity could be seen as a 'curriculum audit' of the various tests, a quality assurance mechanism, by which the experts could scrutinize the extent to which the assessments are relevant to the domain of Critical Thinking and judge the extent of 'fit' of any particular test within the newly defined construct. This activity is consistent with that of Cambridge Approach to validation (Cambridge Assessment, 2008), specifically Principles V4 and V6 - ensuring that the internal structure of an assessment should be consistent with the internal structure of the content domain and ensuring against construct under-representation.

Finally, the definition, taxonomy, rationale and mapping documents were distributed to the relevant subject officers / product managers etc. Some small changes were made (though none to the definition) and the work was very positively received.

Outcomes

The Cambridge Assessment definition of Critical Thinking

Critical Thinking is the analytical thinking which underlies all rational discourse and enquiry. It is characterised by a meticulous and rigorous approach.

As an academic discipline, it is unique in that it explicitly focuses on the processes involved in being rational.

These processes include:

- analysing arguments
- judging the relevance and significance of information
- evaluating claims, inferences, arguments and explanations
- constructing clear and coherent arguments
- forming well-reasoned judgements and decisions.

Being rational also requires an open-minded yet critical approach to one's own thinking as well as that of others.

Rationale / explication of the Cambridge Assessment definition of Critical Thinking

The definition strongly equates Critical Thinking with rationality. Thus, in one sense, Critical Thinking (CT), as an *activity*, is ubiquitous: all rational discourse and enquiry involves the activity and application of CT. Both formal (subject domains across the science-humanities divide) and informal (every day) rational discourse and enquiry rely upon analytical and reasoned thought.

The definition highlights that one of the main features of CT is that it is analytical. Many of the processes of CT rest upon the ability to be analytical; to be able to dissect arguments and information.

Good Critical Thinking is exemplified when the thinking is rigorous and meticulous. That is to say that CT is not passive, automatic, spontaneous or reactive in manner, but is active, careful and thorough.

Whilst CT, as a form of thinking, can be acquired and exercised through incidental exposure in one's general educational experience, the reference to CT as an academic discipline acknowledges that this is a skill which can be explicitly and purposefully learnt and taught. CT comprises a number of processes involved in being rational. These processes are often implicit, hidden or tacit. Studying CT makes these processes unconcealed and explicit. Therefore, whilst a person who has had an absence of any overt CT teaching might still be equipped with a range of CT skills, explicit teaching of CT can introduce awareness or increase proficiency in the processes involved in being rational. The value of the discipline is that it can be applied in all contexts in which reasoning occurs or should occur.

CT emphasises processes - hence the inclusion in the definition of five of the most significant of the many processes of rationality - which encompass the skills and sub-skills outlined in the taxonomy.

Open-mindedness is an important aspect of CT. Being able to set aside one's own views is a pre-requisite for a fair examination of another's argument. Furthermore, open-mindedness allows a person to acknowledge that their own views may be unsupported or even wrong. Critical Thinking involves a fair assessment of evidence, rather than seeking to support or confirm one's own views.

The definition indicates that CT is a set of skills which one applies not only to other people's reasoning, but also to one's own. Being rational requires analysis, evaluation and elucidation of one's own thinking, with the aim of greater accuracy in one's own reasoning.

Taxonomy with expansion

| <i>Skill/process</i> | <i>Sub-skills/processes</i> | <i>Expansion</i> |
|----------------------|--|---|
| 1 Analysis | A Recognising and using the basic terminology of reasoning | E.g. argument, reasons, conclusions, analogy, inference, assumptions, flaws. This skill underpins most critical thinking skills. |
| | B Recognising arguments and explanations | Recognising argument is a fundamental sub skill in Critical Thinking. (An argument is defined as one or more reasons offered in support of a conclusion). Being able to distinguish between argument and non-argument as well as between argument and explanation. |
| | C Recognising different types of reasoning | Recognising that arguments use different types of reasons, e.g. common knowledge, statistics, conditional statements, scientific data, ethical principles etc. More advanced recognition will include recognising different forms of argument, e.g. deductive proof, hypothetical reasoning, reductio ad absurdum. |
| | D Dissecting an argument | Extracting and separating the relevant material from the less relevant (e.g. rhetoric, background). Identifying the key claims which might form parts of the argument. |
| | E Categorising the component parts of an argument and identifying its structure. | Recognising the parts of an argument and the function they play. E.g. evidence, examples, reasons <i>While “dissecting an argument” and “categorising component parts” often co-occur and work together iteratively, they are separate subskills.</i> |
| | F Identifying unstated assumptions | Looking for things (e.g. facts, beliefs, principles) which are essential to the argument but have not been explicitly presented. |
| | G Clarifying meaning | Detecting, avoiding and removing ambiguity for the purposes of reasoning soundly or judging the soundness of reasoning. Removing confusion over the meanings of words, phrases or expression of ideas that might alter the thrust or efficacy of the argument. |
| 2 Evaluation | A Judging relevance | This process is more than simply judging relevant versus irrelevant. It entails judging the <i>degree</i> of relevance of a claim or piece of evidence to a particular interpretation or conclusion. |
| | B Judging sufficiency | Determining whether there is enough evidence to support a conclusion. Recognising the difference between necessary and sufficient conditions. |
| | C Judging significance | This entails judging the degree of importance of evidence in relation to conclusions and arguments. |
| | D Assessing credibility | Assessing the credibility of sources of evidence in relation to such criteria as expertise, corroboration or conflict, reputation, bias, factors that might interfere with accuracy of observation, judgement or reporting. |
| | E Assessing plausibility | In relation to claims, assessing the likelihood that a claim could be true, i.e. “Is this the sort of thing which is likely to happen?” In relation to explanations, assessing the likelihood that the explanation given is the correct one (e.g. by considering alternative explanations). <i>This can often play an important role in assessing arguments.</i> |
| | F Assessing analogies | Judging whether two things being compared are sufficiently alike for the comparison to be useful (i.e. in clarifying and strengthening an argument). |

| | | | |
|---|--|--|---|
| | G | Detecting errors in reasoning | Detecting errors in reasoning includes flaws in arguments, some common fallacies, incorrect inferences/deductions from information contained in a variety of sources (e.g. verbal, numerical, pictorial, graphical), as well as unfair manoeuvres such as irrelevant appeals e.g. to popularity. |
| | H | Assessing the soundness of reasoning within an argument | Making an overall judgement as to how well the conclusion has been supported or justified by the argument as a whole. This will include considering the truth or plausibility of any of the individual claims or reasons, as well as the validity of reasoning (the degree to which the reasons support the conclusion.) The manner of assessment should be appropriate to the type of argument being assessed, e.g. deductive proof, causal reasoning, attempting to prove beyond reasonable doubt, attempting to establish likelihood based on balance of evidence. |
| | I | Considering the impact of further evidence upon an argument | Judging the extent to which further evidence strengthens or weakens an argument. It may challenge, support, complement or conflict with evidence, reasons or unstated assumptions. |
| 3 | Inference | A Considering the implications of claims, points of view, principles, hypotheses and suppositions. | This requires looking at the wider implications of the components of the argument, including its overall conclusion. This will include checking for consistency and corroboration between the claims within an argument. Principles may be ethical principles. |
| | B | Drawing appropriate conclusions | This involves ensuring the conclusion one draws is justified. |
| 4 | Synthesis/ construction | A Selecting material relevant to an argument | Gathering and collating appropriate and sufficient evidence. |
| | B | Constructing a coherent & relevant argument or counter-argument. | Using one's knowledge of argument structure to construct one's own argument. |
| | C | Taking arguments further | Extending an existing argument. Constructing new lines of reasoning which advance the argument. |
| | D | Forming well-reasoned judgements ⁹ | Arriving at carefully considered and more accurate judgements in situations where there is insufficient evidence to allow certainty. (This involves applying all the relevant critical thinking skills) |
| | E | Responding to dilemmas | This skill is applied in a situation where some action has to be taken in response to a problem, but any action taken will have undesirable consequences. It involves recognition of the consequences of competing courses of action, and an attempt to judge between them. |
| | F | Making and justifying rational decisions | Deciding upon the best course of action once a conclusion has been drawn having applied the relevant Critical Thinking skills. |
| 5 | Self-reflection and self-correction | A Questioning one's own pre-conceptions | Gaining awareness of, examining and evaluating one's own pre-conceptions and being prepared to set them aside. |
| | B | Careful and persistent evaluation of one's own reasoning. | Applying all of the above to oneself, with the aim of greater accuracy in one's own reasoning. |

⁹ Judgement is wider than conclusion – it can mean a response, a decision

Other findings and observations

Skills and Processes which are either on the fringes or more clearly outside the construct of Critical Thinking

Part of understanding what Critical Thinking *is* can be informed by understanding what Critical Thinking *is not*: identifying skills which are frequently confused with Critical Thinking, which lie close to the outer fringes, or may often occur concurrently with genuine Critical Thinking processes. Not all 'higher order thinking' is Critical Thinking.

By identifying these skills on the fringes also provides a honed mechanism by which to gauge the presence of construct-irrelevant variance in the tests and qualifications.

For Critical Thinking a number of skills were identified as on the fringes or outside the construct domain. Some of these are detailed below:

- Reading comprehension – while it is most definitely an underlying skill, it is distinct from Critical Thinking in that reading comprehension only asks what is in a passage and may be demonstrated through rephrasing, summarising or précis-ing. Reading comprehension does not, in itself, involve analysing or evaluating. At its closest to Critical Thinking, it involves clarifying the meaning of words or identifying the purpose.
- Problem solving – while it uses many reasoning skills and processes which are a facsimile of those in the Critical Thinking taxonomy is different in that the solution to a problem (generally spatial and/or numerical) replaces the argument.¹⁰
- Creativity - an element of creative or imaginative thinking can sometimes be useful in assessing arguments and explanations (thinking up pieces of further evidence or alternative explanations which might undermine the reasoning) and in constructing one's own arguments. However, creativity is not an end in itself and nor is it an essential skill for Critical Thinking. For this reason, it is not contained within the taxonomy.
- Syllogism - on the fringes of Critical Thinking. Syllogistic arguments are rarely everyday arguments and, as such, the panel viewed syllogism as a largely irrelevant technicality for Critical Thinking.

Mapping of Cambridge Assessment Critical Thinking qualifications and tests

The purpose of this activity was to judge the fit or relevance of any particular test against the objectives of the domain in question.

There is only room here for an overview of the mapping findings. In brief, there were, as one might expect, differences in the domain coverage of the various tests and qualifications i.e. different combinations of sub-skills tested by the various tests, with only one sub-skill common to all, namely 'identifying conclusions'. Differences in domain coverage can be explained by differences in the candidature and contexts of the different specifications.

There was very high congruence between any particular specification and its associated question papers. In just one or two cases, it was judged that some sub-skills were either evidently or implicitly sampled in the question papers or were apparent in the scripts, though not explicit in the specification. It was found that all Critical Thinking products were either substantially or entirely within the definition and taxonomy. Where specifications included sub-skills considered not to be Critical Thinking, this was usually attributable to intervention from external agencies.

Certainly, the taxonomy has provided a useful mechanism by which to map and quality assure existent assessments; to check their curricular relevance and domain coverage and hence provide one strand of evidence to support the inference that individuals who do well in Critical Thinking assessments demonstrate well developed skills in the Critical Thinking domain.

¹⁰ Note that, here, a solution is defined as series of processes leading to the correct answer, and the 'answer' is analogous to a conclusion. The techniques for arriving at a correct solution in Problem Solving are in many cases different to Critical Thinking - e.g. trial and error, and insight are much more important in problem solving than in Critical Thinking.

It is hoped that this definition and taxonomy will provide a shared and common understanding of the construct of Critical Thinking. It provides a focus and a fixed reference point for future specification and assessment materials development work. Furthermore, it is hoped this definition and taxonomy will be valuable to teachers and students of Critical Thinking in providing clarity.

Finally, this activity could constitute an important aspect of validation of any test or qualification. It has the potential to be transferred and utilised in other subject domains as a way of inspecting the extent to which assessment are relevant to a construct domain, judging the extent of 'fit' of any particular test and thus providing one rationale for supporting the adequacy and appropriateness of test score interpretations.

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