Unpacking the content descriptions in the Reasoning strand,
Critical and Creative Thinking

Levels 7–10

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Introduction

This document contains key concepts and ideas to unpack Levels 7–10 Reasoning strand content descriptions from Critical and Creative Thinking. The sample learning activities that are listed could be used to support explicit teaching and/or consolidation of learning. They can be adapted to suit different learning area contexts as required. An indicative achievement standard extract has been given, but depending on the context of the reasoning in the activity, other achievement standard extracts may be relevant.

The F–6 version of this resource is recommended as a complement to this one as it sets out many concepts that are then built on throughout the learning continuum.

Levels 7 and 8

**C****ontent description:** Examine common reasoning errors including circular arguments and cause and effect fallacies [(VCCCTR035)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR035)

**Relevant achievement standard extract:** By the end of Level 8, students … explain and apply a range of techniques to test the strength of arguments.

Sample key concepts and ideas:

* There are several kinds of errors in reasoning (logical fallacies). Many are unintended but some are used as rhetorical devices.
* An example rhetorical device is the slippery slope fallacy, where the intent is to object by claiming that an event will lead to a more highly controversial or catastrophic event(s); for example, opponents of a proposed rule to allow pet dogs at work might claim that, next thing, pet snakes would be let loose in the building. Slippery slope is not always rhetorical; for example, ‘If I fail this test, my life will be ruined for sure’ could be someone’s irrational self-talk.
* A common cause and effect fallacy related to reasoning is where someone thinks that because a particular event appears to lead to a particular effect, it must be the one and only cause, when in fact there might be multiple causes, the cause might be something else entirely or there might be no cause at all. For example, a media headline might state ‘Powerlines near houses blamed for sickness!’ The fallacy occurs when other relevant causal factors, such as the base health of residents and how much wattage is put through the lines, are ignored or downplayed. Or perhaps there is no direct cause at all and it just happens that the residents became sick at the same time. Sometimes the ignoring or downplaying of factors is done deliberately, for rhetorical reasons.
* The gambler’s fallacy occurs when a certain random event is thought to be more likely or less likely given a previous event or series of events, for example, believing that a run of heads when flipping a coin means that tails will probably be next. Some casinos exploit the tendency to make this error by providing sheets to gamblers for tracking outcomes that are not actually dependent.
* Other cause and effect fallacies can occur when analysing if there is a relationship between two variables (see the sample key concepts and ideas regarding caution about cause and effect for [VCCCTR036](#VCCCTR036) in this document).
* Also known as circular reasoning, a circular argument is a type of reasoning in which the conclusion is supported by the premises, which are supported by the conclusion, creating a circle in reasoning where no useful information is being shared. This is erroneous, as the premises are meant to help establish the truth of the conclusion. For example, someone might argue that a contract is watertight because ‘it says so right here in the contract’ or they might say that picking up papers in the yard is good for the environment because picking up papers helps the environment.

Sample learning activities:

* Presenting students with a learning area–based stimulus that is suited to class discussion of reasoning errors and identifying the reasoning issue(s). Stimulus case studies could be found in:
* explanations of observed changes in science, humanities or technologies contexts, for example, with regard to climate change and bushfires
* justifications given for predictions in data trends, for example, selection of lottery numbers
* debate about regulatory issues in the media industry, for example, concerning diversity of content, diversity of perspectives across the industry or degree of media influence
* expression and evaluation of health concerns, for example, statements made about different types of diets or nutritional benefits of foods
* design of an algorithm with conditions that have to be met
* debate about a proposed change. For example, the article [‘How a Chinese restaurant explains Australia’s mask riddle’](https://www.theage.com.au/national/how-a-chinese-restaurant-explains-australia-s-mask-riddle-20200708-p55a1e.html) (Liam Mannix, *The Age*, 11 July 2020) discusses the wearing of face masks in public as a preventive health measure. Students could analyse the article to identify and discuss a range of cause and effect issues raised in the article.
* Investigating rhetorical devices related to reasoning used in advertising or product design. For example, a toothpaste commercial implies that you attract more friends if you use that toothpaste. The advertising campaign might suggest that unless you are using this product, you will not be socially connected or it might suggest that if you are socially connected then it must be because you are using this product.
* Exploring characters with erroneous reasoning in fictional texts, the context for that reasoning, and the implications and consequences of that reasoning across the text, for example, the erroneous reasoning concerning Aboriginal disadvantage expressed in the film *The Sapphires* (2012) when Kay says, ‘If you people worked as much as you fished, you’d be really rich you know.’
* Considering how scientific experiments are used to test ideas or predictions about possible causal relationships, and designing and conducting associated experiments and investigations. For example:
* determining how temperature affects the solubility of salt or sugar in water, plotting data results and deciding whether there is a causal relationship between temperature and solubility, and then discussing and investigating whether there could be other causes for the same effect and whether the results of the experiment can be generalised to other solute–solvent combinations
* designing and conducting investigations such as ‘Does the temperature of food affect the way it tastes?’ and ‘Is foot size related to height?’ and then discussing the results in terms of whether the variables tested are unrelated, correlational or causal and, if causal, whether the cause is correctly attributed.

**C****ontent description:** Investigate the difference between a description, an explanation and a correlation and scepticism about cause and effect [(VCCCTR036)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR036)

**Relevant achievement standard extract:** Students explain different ways to settle matters of fact and matters of value and issues concerned with these.

Sample key concepts and ideas:

* A **description** typically identifies observable characteristics – the ‘what’ of an observation, situation or event.
* An **explanation** attempts to account for how or why something is the way it is. When developing an explanation, we typically suggest links between its own characteristics or links to external influencing factors such as events or stakeholders.
* A **correlation** is a measure of an observed or purported association between two variables, for example, to determine if the association is strong, weak or moderate. When we look for an association between two variables, we are looking to see if there is any relationship between them, while correlation measures an identified association.
* **Ca****ution about cause and effect** can be developed in different learning area contexts and could include not leaping to conclusions about the direction of causality associated with a correlation; being aware that a correlation could be random chance or linked by a third variable; being open-minded regarding the strength of an explanation; being aware that there might be immediate or short term as well as underlying or longer term causes; and recognising that any explanation sits within broader interconnected relationships that are not necessarily explicit in the given explanation.

Sample learning activities:

* Working with different question stems to identify whether these kinds of questions are related to developing a description and/or explanation. Students are given stimulus appropriate to a learning area, such as information about a specific artwork, place, system or event. They use relevant questions to develop a description and an explanation related to the stimulus, reflecting on the difference between the two.
* Discussing data or information associated with two variables that co-occur together in a directional way, for example, where the values of both variables increase or decrease together, or where one value decreases as the other increases. Examples are drawn from relevant learning areas to suit class discussion about how and why caution about cause and effect should be exercised, such as comparing data on injury rates and exercise, discussing different perspectives and interpretations about causes of the Black Death or discussing associations between liveability indicators.
* As part of an English study, undertaking deeper text analysis through a hierarchy of complexity. Students begin with a description of elements from the text and then develop an explanation of these elements, including context, and consider the difference between both kinds of analysis. They go on to identify elements across a text that appear to be associated and use their knowledge of correlation to assist in comparing and analysing these elements.
* Developing knowledge of different features of descriptions and explanations by comparing media reports on an event across different media channels, locally and globally.
* Finding newspaper articles that combine or confuse correlation and causation – for example, the article [‘Sugar rush … to prison? Study says lots of candy could lead to violence’](https://www.cbsnews.com/news/sugar-rush-to-prison-study-says-lots-of-candy-could-lead-to-violence/) (Edecio Martinez, CBS News, 1 October 2009) – and discussing the conclusions drawn in the articles and how further investigations may be conducted to determine whether the relationship is merely a non-causal association or causal.
* Examining a graph showing correlation, for example, [a graph for 'Per capita consumption of cheese (US) correlates with Number of people who died by becoming tangled in their bedsheets’](http://www.tylervigen.com/spurious-correlations) (Spurious Correlations, tylervigen.com) and discussing why ‘correlation does not imply causation’.
* Explaining how the comment ‘I wish that the pilot would stop switching on the “fasten seat belts” sign … every time he does, we get air turbulence’ relates to the concepts of correlation and causation.
* Surveying people to ask, ‘How do you think rainbows are produced?’ and classifying their responses as a description, an explanation, a correlation or an identified cause and effect, and then selecting an illustrative example for each classification category and identifying the strengths and weaknesses of the usefulness of each classification category.
* Improving a given limited explanation. For example, students are presented with a scenario where a new sports uniform is under discussion. In relation to whether the uniform option is good value for money, they are given an initial limited explanation that compares only up-front cost of the uniform to up-front costs of similar products. When developing the explanation further students should consider:
* links between the characteristics of the garment, such as the quality of the fabric and stitching
* other influencing factors, such as time and cost to care for the garment (handwashing needed, dry-clean only, etc.).

**C****ontent description:** Investigate when counter examples might be used in expressing a point of view [(VCCCTR037)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR037)

**Relevant achievement standard extract:** [Students] explain and apply a range of techniques to test the strength of arguments.

Sample key concepts and ideas:

* A counter example is an instance or case that demonstrates that a general statement about something is false. A general statement can sometimes be indicated by the use of words such as ‘always’, ‘never’, ‘all’ or ‘none’, for example, a statement that ‘All fat is unhealthy.’
* A counter example might be used when wanting to challenge or discuss the strength of a rule or general statement, particularly where accuracy is important.
* An identified counter example should be analysed for its significance, to determine how or if a general statement should be modified.
* A counter example can also be used to show that an argument has an invalid form, that is, to show that while the premises in an argument are true, the conclusion may be false because the conclusion does not follow from the premises. For example, someone might argue that ‘This shirt must be made of cotton because it is made of a breathable fabric, and cotton is breathable.’ Linen (another breathable fabric) can be used as a counter example to show how the argument is invalid. It may turn out that the shirt is made of cotton but it does not logically follow that it is – we would have to check the material.

Sample learning activities:

* Considering why checking the accuracy of statements and validity of arguments when developing a point of view is important, including the role of counter examples in helping to do this. Students consider cases that are relevant to a learning area, such as when classifying organisms, discussing relationships between price movements and quantity demanded in markets, or developing an algorithm for a digital solution.
* Exploring the use of counter examples as part of a media investigation, for example, when investigating different documentary styles and how accuracy within points of view is represented.
* Identifying a counter example to show that a general statement about numbers is false, for example, the number 2 as a counter example to the statement that all prime numbers are odd.
* As part of an exploration of stereotyping, identifying counter examples from communities that speak different languages, for example, in response to the statement ‘Everyone knows that a loud discussion means that an argument is going on.’
* Providing examples of experimental data or findings related to the statement that ‘Kites need tails to fly’ that would (a) support the statement and (b) not support the statement, including consideration of whether one experimental data point or finding that does not support the statement is sufficient to make the statement incorrect.
* Corroborating a range of historical sources on a significant event or individual and identifying evidence from the sources that confirms, contradicts or poses a different view or interpretation.

**Content description:** Consider how to settle matters of fact and matters of value and the degree of confidence in the conclusion [(VCCCTR038)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR038)

**Relevant achievement standard extract:** Students explain different ways to settle matters of fact and matters of value and issues concerned with these.

Sample key concepts and ideas:

* Different disciplines have different ways of approaching an issue of disagreement or a dispute involving a factual judgment and/or value judgment.
* When attempting to settle a matter we might seek credible evidence for and against contested matters, drawing on the relevant disciplinary approach to seeking evidence.
* What is credible evidence will depend on the kind of question we are trying to answer. For example, deciding the value of an artwork could mean establishing a dollar value or how much it means to someone personally; hence, the evidence and source of authority sought will be different in each case.
* We need to think carefully about appropriate sources of authority and how they are weighted, for example, on what basis would we choose particular professionals, general citizens or other stakeholders as sources of authorities in a matter?
* The source of authority might influence the process we use to settle a matter, for example, asking for a report, convening a community forum or expert panel, or a putting something to popular vote.
* When there is some disagreement, including among experts, we need to consider how important it is to reach consensus and the level and areas of disagreement that can be tolerated. Again this depends on the specific matter and the discipline(s) involved. For example, deciding on a factual matter such as whether an artwork is a fake would involve a range of experts from different disciplinary backgrounds, such as history, science and the visual arts. Settling matters of value can at times involve purely subjective individual judgments but at other times also require a way of managing disagreements among identified sources of authority, for example, when determining the cultural significance of an artwork under consideration for purchase by a museum.

Sample learning activities:

* As part of planning research into a contested issue, exploring what would constitute credible evidence, including the kind of evidence and from which sources of authority it comes and why. Students also consider the level of consensus that is reasonable to expect, for example, among academic experts, citizens, or groups of practitioners or other stakeholders. For example:
* when researching the merits of different diets, students consider the credibility of *Australian Dietary Guidelines*, celebrity chefs, naturopaths, accredited practising dietitians and self-appointed nutritionists
* when researching the sustainability of a design, students consider the credibility of manufacturer claims, environmental groups and government authorities.
* As part of an inquiry into a local planning issue such as an issue around an art installation, identifying appropriate sources of authority and explaining how they should be weighted, for example, how the views of citizens, a local art expert and the artist on the aesthetics of the installation should be weighted.
* As part of an investigation into social media, examining controversy surrounding social media as a forum for debate.
* Using sample statistics to estimate the proportion of a population that supports a particular point of view and developing understanding of variation between samples and how this affects reliability and confidence with respect to informal inference.
* Investigating how science knowledge and understanding is developed and producing a timeline of how a scientific theory (for example, cell theory or atomic theory), a model (for example, particle model) or an object (for example, a microscope, telescope or electrical device) has developed over time, identifying what was thought to be ‘opinion’, ‘fact’ and ‘theory’ at the time.
* Accessing different articles and opinions related to a contestable science-related issue – for example ‘Should the wearing of face masks be compulsory in winter months post the coronavirus (COVID-19) pandemic?’ – and evaluating the authority of the article source (for example, website, newspaper or journal), the author (qualifications and/or specialisations) and sources used within the article.
* Investigating a contemporary contested history, for example, the place of historical statues or the preservation of Aboriginal and Torres Strait Islander sacred sites.
* Using two different historical interpretations or perspectives of a significant event or individual and evaluating their usefulness and/or the reliability of these sources of evidence.

**C****ontent description:** Examine how to select appropriate criteria and how criteria are used in clarifying and challenging arguments and ideas [(VCCCTR039)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR039)

**Relevant achievement standard extract:** [Students] explain and apply a range of techniques to test the strength of arguments.

Sample key concepts and ideas:

* ‘Criteria’ are principles or standards by which we decide on something.
* Thinking about whether we are describing something or evaluating something can help to guide our selection of criteria.
* With regard to descriptions, sometimes criteria are selected as a basis for classification (for example, when describing the genre of text or describing organisms) and sometimes to set a scale (for example, when describing proximity of regional towns to a larger city or describing how one product compares to another).
* With regard to evaluations, criteria are selected to assist in judging if an idea is correct, incorrect, right, wrong, good or bad. This can involve individuals or groups setting one or more standards, ideals, aims, purposes or similar. So we might develop descriptions to compare the specifications of two mobile phones but evaluate which one is better according to a purpose that we have in mind. In terms of resolving disagreements, criteria can be used to assist evaluations of the acceptability of various ideas.
* Criteria often play a role in arguments. Asking to clarify criteria can help to identify the basis for an agreement or disagreement about the premises used in the argument. For example, the basis for a disagreement involving a friend’s actions might involve differences in what each person holds as criteria for being a ‘good’ friend.
* At a deeper level, clarifying or resolving contested ideas and premises might involve not only exploring the set of criteria itself but how important each criterion is and how they might relate to each other. For example, two people might agree that a set of criteria for being a ‘good’ friend includes someone you can trust, who is fun to be with, who is constructively critical of your life choices and who is a good listener, but they might disagree on how important each of these is or whether being trustworthy and a good listener are related to each other.

Sample learning activities:

* Investigating a current contested issue such as debates on freedom of speech or whether a particular work counts as ‘high quality’ art or music. Students examine how clarifying the criteria underpinning these concepts could assist in analysing the debate. They discuss the issue with peers, drawing on their knowledge of the role of criteria to clarify ideas and engage with disagreements.
* Comparing arguments for and against an idea and selecting and using evaluative criteria as part of their justification for their response, for example, in discussing proposed solutions to an environmental issue or what or who should be included in a sample population when undertaking data collection.
* With guidance, selecting and applying a set of environmental, economic and social criteria for evaluating the liveability of places. Students work in small groups to apply the outcome of their evaluation to inform and plan for appropriate strategies to enhance the liveability of places, especially for young people, including examples from Australia and Europe, using the criteria to assist in resolving disagreements.
* Considering assumptions and constraints with respect to mathematical models of real-world phenomena, such as the spread of disease, and the validity and limitations of these models for predictive purposes.
* Identifying that the meaning of ‘politeness’ is contested, through exploration of dialogue between two different language speakers concerning whether a particular gesture is polite and reflecting on the best way to approach a discussion about politeness across different cultures.
* Collecting a set of objects (such as shells, leaves or a range of household objects) and developing a dichotomous key for their classification, followed by testing of the key by peers to see if the key ‘works’.
* When discussing the historical significance of a historical event or individual, discussing criteria to judge this significance: How important was it to people who lived at that time? How many people were affected? How were people’s lives changed? How long lasting were the consequences? What is its legacy?
* Developing and using criteria associated with democratic freedoms to support discussion on the right and responsibility of compulsory voting in Australia and the extent to which this does or does not impede democratic freedoms.

Levels 9 and 10

**Content description:** Examine a range of rhetorical devices and reasoning errors, including false dichotomies and begging the question [(VCCCTR046)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR046)

**Relevant achievement standard extract:** By the end of Level 10, students … explain and apply a range of techniques to test validity within and between arguments.

Sample key concepts and ideas:

Note: These sample key concepts and ideas build on the sample key concepts and ideas for the Levels 7 and 8 content description on reasoning errors [(VCCCTR035)](#VCCCTR035) in this document.

* A false dichotomy related to reasoning occurs when an argument gives the impression that we face a stark choice between two alternatives but more choices exist or there is a spectrum of choices between the two, for example, ‘Would you rather learn to cook or eat unhealthy takeaway for the rest of your life?’
* Begging the question involves making a statement that assumes the question being argued for has already been settled – it takes for granted what it is supposed to prove. For example, the question at issue might be ‘Should girls be allowed to play against boys in this game?’ If someone then makes a statement such as ‘Allowing girls on the field is fair’, they are begging the question as they have already taken the question as settled and have not contributed anything to help progress the question in dispute.
* Begging the question could refer to part of an argument drawing a conclusion about the disputed question (and so be part of a circular argument – see [VCCCTR035](#VCCCTR035)) or it could simply refer to the relevant statement itself. Standalone statements that beg the question typically appear in the form of a question that has within it a claim that should be separately argued for, for example, asking a defendant in a court trial ‘What was robbing the bank like?’ Sometimes these kind of questions are called leading questions. (Also, sometimes people say ‘begs the question that …’ when they simply mean ‘raises the question’ not the logical fallacy described here.)

Sample learning activities:

* Considering a learning area–based argument involving false dichotomies. For example:
* If you eat meat, this shows that you don’t care about animals.
* You can either buy this product and be cool or don’t and face being uncool.
* If you can’t admit that you love Australia, then you must hate it.
* Analysing any rhetorical role that such statements play and identifying whether there is a false dichotomy involved.
* Using knowledge of relevant reasoning errors to develop test-and-trace tables and investigate sources of error for computer programs.
* Deepening understanding of the nature of false dichotomies when exploring how they drive narrative and events in texts such as Shakespearean tragedies (for example, *Othello, Romeo and Juliet* and *Macbeth*). Students go on to explore rhetorical devices within these texts, for example, how they can create a tension between emotion and reason.
* As part of their investigation of contemporary art, discussing whether there is a false dichotomy involved in the question ‘Is it Art or not?’.
* As part of their investigation of a current issue related to the visual arts, such as cancel culture, exploring how rhetorical devices can be visually expressed, as well as textually expressed, and identifying and discussing any reasoning errors encountered in different perspectives.
* When exploring predict–observe–explain (POE) strategies in Science, considering the place of reasoning when reconciling inconsistencies between their predictions and observations, including begging the question. For example, undertaking a POE with regard to two objects with different masses falling at the same speed in a vacuum, and analysing responses that claim that the experiment was faulty or a trick.

**Content description:** Examine how to identify and analyse suppressed premises and assumptions [(VCCCTR047)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR047)

**Relevant achievement standard extract:** Students structure complex valid arguments. They explain and apply a range of techniques to test validity within and between arguments.

Sample key concepts and ideas:

* Arguments are structured with at least one premise (a statement intended to establish how true a conclusion is) offered in support of a conclusion.
* In practice, sometimes one or more of the premises are implied (suppressed), that is, not made explicit in an argument. This might be because the premise is thought to self-evident and therefore does not require explicit unpacking.
* When you think that a premise is not obvious then making it an explicit part of your argument can help to establish if the argument is valid, that is, if the conclusion follows from the premise(s).
* When someone else’s argument seems to be missing a premise and you want to check what this is, it can help to map out the argument to see where the gap is. One strategy can be to see if all the key terms in the conclusion are represented in the premise(s). For example, if an argument has the conclusion that ‘the Australian Government is currently providing enough support for the renewable energy sector’, we would look to see if the key terms in the conclusion, including ‘currently’, ‘providing’ and ‘enough support’, are explicitly addressed in the premise(s) or if there is a gap. We would also look to see if terms like ‘Australian Government’ and ‘renewable energy sector’ have assumed meanings or are explicitly defined. If there is a gap, we then need to determine if the premise needs to be made explicit because it is not self-evident.
* Mapping an argument can be done diagrammatically, with the conclusion of an argument identified as well as its premise(s) (which themselves might be conclusions of intermediate arguments within the larger argument). See the sample learning activities below for an example.
* An assumption is a premise that is taken for granted in an argument without necessarily being true. Assumptions are typically used to speed up construction of an argument. They often arise from applying something from past experience to a new situation, for example, we might make assumptions about particular behaviours or risks based on our past experience.
* Assumptions can be explicit or implicit in arguments. Making them explicit can help us check the validity of an argument.

Sample learning activities:

* Investigating false proofs of Zeno’s paradoxes and mathematical absurdities such as 2=1.
* Applying understanding of ‘false positives’ and ‘false negatives’ to consider the role that identifying and analysing assumptions plays in resolving disputes about medical testing, for example, challenging a requirement for follow-up tests.
* Considering the use of diagrams in support of geometric proofs and how they can embed unstated assumptions.
* With guidance, using a tool such as a lotus diagram to develop an understanding of the structure of complex arguments, for example, those that have a main conclusion and linked intermediate arguments for or against the main conclusion. (A lotus diagram template is provided in [the appendix](#App1).) The main conclusion of an argument is entered into the central box of the central section of the lotus diagram and the premises are entered in the boxes immediately around it. Where appropriate the diagram can be used to show how the premises in turn can become the conclusions of intermediate arguments within the main argument. Each intermediate conclusion is entered into the central box of one of the sections of the lotus diagram that is connected to the central section and then the premises are added to create the full intermediate argument.

For example, students are provided with a main contention that will be tested as part of an inquiry, such as ‘The use of banned performance-enhancing drugs in sport (doping) is wrong’ and enter this into the central box in the lotus diagram (see an excerpt from this lotus diagram below). They identify premises that the contention could be based on, for example, ‘It goes against the sporting ideal of a level playing field’ and enter this into one of the surrounding boxes. As the premises are entered, the validity of the argument, that is, the logical relationship between the premises and conclusion, is monitored.

The lotus diagram is then used to identify focus areas for the inquiry, for example, research might be undertaken to find out if in fact there are significant health risks (for further discussion of the issue of doping see, for example, [‘How to argue about doping in sport’](https://theconversation.com/how-to-argue-about-doping-in-sport-43600), Pushbikewriter, The Conversation, 23 June 2015). The research findings are then used to develop an intermediate argument about health risks and doping.

As students undertake the inquiry, they use the lotus diagram to refine their arguments about doping, including refining the contention if need be. The final lotus diagram should show the structure of the refined argument produced as a result of their research, with the main conclusion in the centre and surrounding intermediate arguments. This diagram can then be used as the basis for a sustained written response or presentation.

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| It can involve significant health risks for the individual. |  | It goes against the sporting ideal of a level playing field. |
|  | The use of banned performance-enhancing drugs in sport (doping) is wrong. |  |
|  |  |  |

**Content description:** Investigate the nature and use of counter examples structured as arguments [(VCCCTR048)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR048)

**Relevant achievement standard extract:** Students structure complex valid arguments. They explain and apply a range of techniques to test validity within and between arguments.

Sample key concepts and ideas:

Note: These sample key concepts and ideas expand on the definition of counter examples found in the sample key concepts and ideas for the Levels 7 and 8 content description [VCCCTR037](#VCCCTR037)  in this document.

We can expand on a counter example to generate an argument in support of it.

This can be worthwhile where the raising of a counter example is trying to do more than merely point out an exception to show that a general statement is false. For example, someone might offer the argument ‘Any behaviour that results in physical harm should be punished with a jail sentence as we must do all we can to protect society from violence like this.’ We might want to challenge this. Simply raising a counter example like ‘What about some driving accidents?’ would not go far enough and we would need to go further to develop an argument that some driving accidents, while resulting in physical harm, are not intentional nor foreseeable and it would be unfair to jail people for these.

Sample learning activities:

* Discussing scenarios based on a learning area context where expanding on a counter example that challenges a general statement is useful to clarify an argument or otherwise progress a debate; for example, drawing from debates on:
* the impact of particular recreational activities on environments, with a general statement such as ‘All recreational activities damage environments’
* how characteristics of groups should be represented in visual or written texts, with a general statement such as ‘Members of any ethnic group should always be shown in non-stereotypical work roles’.
* Considering counter examples and supporting arguments for them when investigating the trade-offs involved in designing algorithms to create digital solutions.

**Content description:** Consider ambiguity and equivocation and how they affect the strength of arguments [(VCCCTR049)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR049)

**Relevant achievement standard extract:** [Students] explain and apply a range of techniques to test validity within and between arguments.

Sample key concepts and ideas:

* Ambiguity refers to a term, phrase or statement being open to more than one interpretation. This can be intentional or unintentional. When someone is intentionally ambiguous or vague in making an argument, we can say they are being equivocal.
* Ambiguity affects the clarity and coherence of statements within arguments and can be misleading. Where it is not possible to simply avoid ambiguity through the use of precise language, explicitly declaring the meaning or interpretation will improve clarity.
* Someone might use equivocating statements in an argument when they are hoping for multiple interpretations in order to be persuasive to as wide a group as possible, to be humorous or to delay a definitive interpretation while seeing what effect the argument has on stakeholders.
* It is, however, an error in reasoning to use one meaning for a term in one part of an argument and then switch to another meaning of that term later and then claim that the conclusion that follows is valid – for example, to argue for publishing a particular article by claiming ‘The public are interested in it, and we have a duty to publish in the public interest’ where ‘public interest’ has two different meanings (‘anything the public might be curious about’ and ‘contexts thought to have ethical significance for the public’). Using ‘public interest’ in two different ways like this is called an equivocation fallacy.

Sample learning activities:

* Identifying ambiguous terms within mocked-up contracts as part of a financial literacy program or identifying ambiguity in client briefs for designed or digital solutions, and discussing the effect on future dispute resolution.
* Analysing examples of equivocation in political or civic discourse and the effects on stakeholders or the community.
* Identifying ambiguous terms in English or texts in other languages and discussing the effect on interpretation of meaning and whether the ambiguity might be intentional or not.
* Analysing simple arguments to identify an equivocation fallacy.
* Checking scientific communication for precision and equivocation, for example, between scientific and everyday meanings of terms, such as ‘mass’ for a physicist (one of the properties of a physical body and a measure of its resistance to acceleration when a net force is applied), an architect (‘building mass’) or an average person (a large volume of matter).

**Content description:** Investigate use of additional and refined criteria when application of original criteria does not produce a clear conclusion [(VCCCTR050)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCCCTR050)

**Relevant achievement standard extract:** [Students] explain and apply a range of techniques to test validity within and between arguments.

Sample key concepts and ideas:

* Identifying and applying criteria to statements and ideas within arguments (see the sample key concepts and ideas for the Levels 7 and 8 content description [VCCCTR039](#VCCCTR039)) may not produce the clarity sought, with regards to reasoning.
* Additions or refinements to criteria are concerned with improving their reliability and certainty. How this is done will depend on the discipline underpinning the learning area context, for example, the precision of criteria used in science can be improved if criteria are specific, measurable, agreed and time-bound.

Another strategy is to consider necessary and sufficient conditions for claims, which involves making a distinction between what may be:

* necessary but not sufficient
* sufficient but not necessary
* both necessary and sufficient
* neither necessary nor sufficient.

For example, we might be seeking to refine criteria for whether someone can ride a bike. Doing amazing circus tricks on a bike is sufficient in that it is enough on its own to indicate someone can ride a bike – but it is not a necessary condition, in that it is unreasonable to expect every bike rider to be able to do amazing circus tricks. On the other hand, the ability to steer a bike is necessary but not sufficient –braking and propelling oneself in an upright position are also needed to ride a bike.

Similarly, being an animal is necessary for being a dog but it is not sufficient, and being a dog is a sufficient for being an animal but not necessary (that is, there are other animals).

Sample learning activities:

* Using a learning area scenario, and with guidance, discussing issues raised by the use of unclear criteria. The criteria are refined through class discussion, using the relevant disciplinary approach. Example contexts include:
* evaluating digital or design solutions or health information
* investigating social cohesion
* researching statistical data associated with a given set of variables or indicators, such as living standards.
* Examining an incomplete set of criteria and justifying selection of additional criteria, drawing on their knowledge of necessary and sufficient conditions and discussing the usefulness of doing this. Illustrative learning area contexts include considering criteria:
* for defining a concept, such as an ecosystem, historical significance, street dance or satire
* underpinning selection of factors that will be used to analyse a health and wellbeing issue, or the sustainability of a particular practice.
* Developing and refining a list of criteria for evaluating proposed digital or designed solutions against user needs, using their knowledge of necessary and sufficient conditions. Is it necessary or sufficient to have a graphical user interface (GUI), for example, for a design to meet user needs?
* Applying an incomplete set of environmental economic and social criteria to evaluate responses to managing environmental change in Australia and at least one other country. By predicting the future outcomes and further consequences of management responses, students justify development and selection of additional criteria, in order to appropriately evaluate management responses to environmental change.
* Further developing mathematical models through adjusting constraints based on empirical evidence, for example, when applying different growth models.
* Designing and conducting an investigation to determine a rank order from ‘best’ to ‘worst’ brand of absorbent paper, including developing criteria to unpack the meaning of ‘best’, and adding or refining criteria in the situation where two brands cannot be differentiated in terms of ranking.

Appendix – Example of a complex argument structured in a lotus diagram

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|  | **Intermediate conclusion A** |  |  | **Intermediate conclusion B** |  |  | **Intermediate conclusion C** |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  | **Premise A** | **Premise B** | **Premise C** |  |  |  |
|  | **Intermediate conclusion D** |  | **Premise D** | **Conclusion** | **Premise E** |  | **Intermediate conclusion E** |  |
|  |  |  | **Premise F** | **Premise G** | **Premise H** |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  | **Intermediate conclusion F** |  |  | **Intermediate conclusion G** |  |  | **Intermediate conclusion H** |  |
|  |  |  |  |  |  |  |  |  |