Critical and creative thinking

Introduction

In the Australian Curriculum, students develop capability in critical and creative thinking as they learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems. Critical and creative thinking are integral to activities that require students to think broadly and deeply using skills, behaviours and dispositions such as reason, logic, resourcefulness, imagination and innovation in all learning areas at school and in the lives beyond school.

The Melbourne Declaration on Educational Goals for Young Australians (MCEETYA 2008) recognises that critical and creative thinking are fundamental to becoming successful learners. Thinking that is productive, purposeful and intentional is at the centre of effective learning. By applying a sequence of thinking skills, students develop an increasingly sophisticated understanding of the processes they can employ whenever they encounter problems, unfamiliar information and new ideas. In addition, the progressive development of knowledge about thinking and the practice of using thinking strategies can increase students’ motivation for, and management of, their own learning. They become more confident and autonomous problem-solvers and thinkers.

Responding to the challenges of the twenty-first century – with its complex environmental, social and economic pressures – requires young people to be creative, innovative, enterprising and adaptable, with the motivation, confidence and skills to use critical and creative thinking purposefully.

Scope of Critical and creative thinking

This capability combines two types of thinking – critical thinking and creative thinking. Though the two are not interchangeable, they are strongly linked, bringing complementary dimensions to thinking and learning.

Critical thinking is at the core of most intellectual activity that involves students in learning to recognise or develop an argument, use evidence in support of that argument, draw reasoned conclusions, and use information to solve problems. Examples of thinking skills are interpreting, analysing, evaluating, explaining, sequencing, reasoning, comparing, questioning, inferring, hypothesising, appraising, testing and generalising.

Creative thinking involves students in learning to generate and apply new ideas in specific contexts, seeing existing situations in a new way, identifying alternative explanations, and seeing or making new links that generate a positive outcome. This includes combining parts to form something original, sifting and refining ideas to discover possibilities, constructing theories and objects, and acting on intuition. The products of creative endeavour can involve complex representations and images, investigations and
performances, digital and computer-generated output, or occur as virtual reality.

Concept formation is the mental activity that helps us compare, contrast and classify ideas, objects, and events. Concept learning can be concrete or abstract and is closely allied with metacognition. What has been learned can be applied to future examples. It underpins the elements outlined below. Dispositions such as inquisitiveness, reasonableness, intellectual flexibility, open- and fair-mindedness, a readiness to try new ways of doing things and consider alternatives, and persistence both promote and are enhanced by critical and creative thinking.

Critical and creative thinking can be encouraged simultaneously through activities that integrate reason, logic, imagination and innovation – for example, focusing on a topic in a logical, analytical way for some time, sorting out conflicting claims, weighing evidence, thinking through possible solutions, and then, following reflection and perhaps a burst of creative energy, coming up with innovative and considered responses. Critical and creative thinking are communicative processes that develop both flexibility and precision. Communication is integral to each of the thinking processes. By sharing thinking, visualisation and innovation, and by giving and receiving effective feedback, students learn to value the diversity of learning and communication styles.

For a description of the organising elements for Critical and creative thinking, click here.

Organising elements

The Critical and creative thinking learning continuum is organised into four interrelated elements, each detailing differing aspects of thinking. The elements are not a taxonomy of thinking. Rather, each makes its own contribution to learning and needs to be explicitly and simultaneously developed.

- Inquiring – identifying, exploring and clarifying information
- Generating innovative ideas and possibilities
- Reflecting on thinking, actions and processes
- Analysing, synthesising and evaluating information.

The diagram below sets out these elements.
Organising elements for Critical and creative thinking

Inquiring – identifying, exploring and clarifying information

This element involves students in the identification and clarification of questions and issues, followed by gathering and processing information. When gathering, exploring and clarifying information and ideas creatively, students develop the capacity to be open-minded and ask different kinds of questions. Identifying and facing new challenges and opportunities leads them to more effectively process new information and more efficiently expand their knowledge. In summary, inquiring primarily consists of:

• identifying, exploring and clarifying questions and issues
• gathering, organising and processing information
• transferring knowledge into new contexts.

Generating and developing ideas and possibilities

This element involves students in the investigation, organisation and evaluation of ideas through considering alternatives and seeking innovative solutions. Students generate and develop ideas and possibilities through engagement in challenging activities. Learning to plan and manage thinking aids the development of intellectual flexibility and leads to the consolidation of learning. In summary, generating primarily consists of:

• imagining possibilities and considering alternatives
• seeking and creating innovative pathways and solutions
• suspending judgment to visualise possibilities.
Reflecting on thinking, actions and processes

This element involves students in suspending judgment and reflecting on thinking processes (metacognition), procedures and products to create alternatives or open up possibilities. Through using these thinking skills, processes and dispositions, students gain an understanding of how to best achieve outcomes. They practise the categorisation and linking of ideas in innovative ways. In summary, reflecting primarily consists of:

- reflecting on thinking (metacognition)
- reflecting on procedures and products.

Analysing, evaluating and synthesising information

This element involves students in analysing, synthesising and applying logic, and reflecting on how to best tackle issues, tasks and challenges. Students assess and select from a range of thinking strategies to evaluate ideas and information and draw conclusions. Finding new contexts to employ these conclusions selectively, and synthesising their knowledge, assists in the design of a course of action. In summary, analysing primarily consists of:

- applying logical and inventive reasoning
- drawing conclusions and designing a course of action.

Critical and creative thinking across the curriculum

The imparting of knowledge (content) and the development of thinking skills are accepted today as primary purposes of education. The explicit teaching and embedding of critical and creative thinking throughout the learning areas encourages students to engage in higher order thinking. By using logic and imagination, and by reflecting on how they best tackle issues, tasks and challenges, students are increasingly able to select from a range of thinking strategies and employ them selectively and spontaneously in an increasing range of learning contexts.

Activities that foster critical and creative thinking should include both independent and collaborative tasks, and entail some sort of transition or tension between ways of thinking. They should be challenging and engaging, and contain approaches that are within the ability range of the learners, but also challenge them to think logically, reason, be open-minded, seek alternatives, tolerate ambiguity, inquire into possibilities, be innovative risk-takers and use their imagination.

Critical and creative thinking is addressed through the learning areas and is identified wherever it is developed or applied in content descriptions. It is also identified where it offers opportunities to add depth and richness to student learning in content elaborations. An icon indicates where critical and creative thinking has been identified in learning area content descriptions and elaborations. A filter function on the Australian Curriculum website assists
users to identify F–10 curriculum content where critical and creative thinking has been identified. Teachers may find further opportunities to incorporate explicit teaching of critical and creative thinking depending on their choice of activities. Students can also be encouraged to develop capability through personally relevant initiatives of their own design.

**English**

Critical and creative thinking are essential to developing understanding in English. Students employ critical and creative thinking through discussions, the close analysis of texts and through the creation of their own written, visual and multimodal texts that require logic, imagination and innovation. Students use creative thinking when they imagine possibilities, plan, explore and create ideas and texts.

Through listening to, reading, viewing, creating and presenting texts and interacting with others, students develop their ability to see existing situations in new ways, and explore the creative possibilities of the English language. In discussion students develop critical thinking as they state and justify a point of view and respond to the views of others. Through reading, viewing and listening students critically analyse the opinions, points of view and unstated assumptions embedded in texts.

**Maths**

Students develop critical and creative thinking as they learn to generate and evaluate knowledge, ideas and possibilities, and use them when seeking solutions. Engaging students in reasoning and thinking about solutions to problems and the strategies needed to find these solutions are core parts of the Mathematics curriculum.

Students are encouraged to be critical thinkers when justifying their choice of a calculation strategy or identifying relevant questions during a statistical investigation. They are encouraged to look for alternative ways to approach mathematical problems, for example, identifying when a problem is similar to a previous one, drawing diagrams or simplifying a problem to control some variables.

**Science**

Students develop capability in critical and creative thinking as they learn to generate and evaluate knowledge, ideas and possibilities, and use them when seeking new pathways or solutions. In the Science learning area, critical and creative thinking are embedded in the skills of posing questions, making predictions, speculating, solving problems through investigation, making evidence-based decisions, and analysing and evaluating evidence. Students develop understandings of concepts through active inquiry that involves planning and selecting appropriate information, and evaluating sources of information to formulate conclusions.
Creative thinking enables the development of ideas that are new to the individual, and this is intrinsic to the development of scientific understanding. Scientific inquiry promotes critical and creative thinking by encouraging flexibility and open-mindedness as students speculate about their observations of the world. Students’ conceptual understanding becomes more sophisticated as they actively acquire an increasingly scientific view of their world.

**History**

Critical thinking is essential to the historical inquiry process because it requires the ability to question sources, interpret the past from incomplete documentation, develop an argument using evidence, and assess reliability when selecting information from resources. Creative thinking is important in developing new interpretations to explain aspects of the past that are contested or not well understood.

**Background**

This background summarises the evidence base from which the Critical and creative thinking capability’s introduction, organising elements and learning continuum have been developed. It draws on foundational and recent international and national research, as well as initiatives and programs that focus on critical and creative thinking across the curriculum.

Critical and creative thinking are variously characterised by theorists as dispositions (Tishman, Perkins and Jay; Ritchhart, Church and Morrison), taxonomies of skills (Bloom; Anderson, Krathwohl et al.), habits and frames of mind (Costa and Kallick; Gardner; de Bono), thinking strategies (Marzano, Pickering and Pollock), and philosophical inquiry (Lipman, Sharp and Oscanyan). Each of these approaches has informed the development of the Critical and creative thinking capability.

The capability is concerned with the encouragement of skills and learning dispositions or tendencies towards particular patterns of intellectual behaviour. These include being broad, flexible and adventurous thinkers, making plans and being strategic, demonstrating metacognition, and displaying intellectual perseverance and integrity. Students learn to skilfully and mindfully use thinking dispositions or ‘habits of mind’ such as risk taking and managing impulsivity (Costa and Kallick 2000) when confronted with problems to which solutions are not immediately apparent.

Both Gardner (1994) and Robinson (2009) emphasise that we need to understand and capitalise on the natural aptitudes, talents and passions of students – they may be highly visual, or think best when they’re moving, or listening, or reading. Critical and creative thinking are fostered through opportunities to use dispositions such as broad and adventurous thinking, reflecting on possibilities, and metacognition (Perkins 1995), and can result from intellectual flexibility, open-mindedness, adaptability and a readiness to
experiment with and clarify new questions and phenomena (Gardner 2009). Recent discoveries in neuroscience have furthered theories about thinking, the brain, perception and the link between cognition and emotions. Theorists believe that learning is enhanced when rich environments contain multiple stimuli, stressing the importance of engaging the mind’s natural curiosity through complex and meaningful challenges.

Educational taxonomies map sequences of skills and processes considered to be foundational and essential for learning. The most well known of these, developed by Bloom et al. (1956), divided educational objectives into domains where learning at the higher levels was dependent on having attained prerequisite knowledge and skills at lower levels. In 1967, Bruner and colleagues described the process of concept learning as an active process in which learners construct new concepts or ideas based on their knowledge. The philosophical inquiry model, first applied to school education by Lipman, Sharp and Oscanyan (1980), has two major elements: critical and creative thinking, and forming a classroom environment called a ‘community of inquiry’, to support the development of thinking and discussion skills. This model places emphasis on possibilities and meanings, wondering, reasoning, rigour, logic, and using criteria for measuring the quality of thinking.

Lave and Wenger (1991) described ‘learning communities’ that value their collective competence and learn from each other. Through their notion of ‘authentic’ learning, the importance of engagement and linking student interests and preferred learning modes with classroom learning has emerged. Marzano, Pickering and Pollock (2001) identified the strategies most likely to improve student achievement across all content areas and grade levels. These include using non-linguistic representations and learning organisers, and generating and testing hypotheses.

In 2001, Anderson and Krathwohl changed Bloom’s cognitive process of ‘synthesis’ to ‘creativity’ and made it the highest level of intellectual functioning. They believed the ability to create required the production of an original idea or a product from a unique synthesis of discrete elements.

Twenty-first century learning theories emphasise the importance of supporting authentic and ubiquitous (anywhere, anyhow) learning, and providing students with opportunities, resources and spaces to develop their creative and critical thinking skills (Newton and Fisher 2009; McGuinness 1999, 2010). Gardner’s (2009) five ‘minds’ for the future – the disciplined, synthesising, creating, respectful and ethical minds – offers a helpful starting place. Learners need to develop the skills to analyise and respond to authentic situations through inquiry, imagination and innovation.

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Critical and creative thinking continuum across stages of schooling

Inquiring – identifying, exploring and clarifying information

Identifying, exploring and clarifying questions and issues

By the end of Year 2 students:
• pose questions to explore issues in their own world (for example asking why certain actions and events occurred)
• identify main ideas and clarify meaning in information (for example examining themes in texts or images)

By the end of Year 6 students:
• pose questions that identify and describe issues beyond their immediate world (for example questioning conventional responses to local and world events, asking who, when and why)
• identify main ideas and clarify meaning in information (for example examining themes in texts or images)
• prioritise ideas and select information to form a considered and/or creative response to an issue (for example giving reasons for preferring a photo or a memory to recall an occasion)

By the end of Year 10 students:
• pose questions that probe complex and abstract ideas about societal issues (for example developing and modifying questions to inform an inquiry, uncover complexity or provoke argument)
• explore the coherence and logic of multiple perspectives on an issue (for example exploring contrasting positions such as in an environmental issue)

Gathering, organising and processing information

By the end of Year 2 students:
• organise information based on similar ideas from given sources (for example finding examples of kindness in several resources)
• compare and contrast points identified within information

By the end of Year 6 students:
• identify and categorise information from multiple sources (for example establishing issues of a similar nature in literature and film)
• sequence, paraphrase, elaborate or condense information from a range of sources
By the end of Year 10 students:
• pose questions to test possibilities and examine independently sourced data for bias and reliability (for example critiquing a range of sources to establish ways of verifying reliability) sequence, paraphrase, elaborate or condense information from a range of sources
• process complementary and contradictory information from primary and secondary sources

Transferring knowledge into new contexts

By the end of Year 2 students:
• use relevant information from a previous experience to inform a new experience (for example recalling the reasons previously given and applying them in new situations)

By the end of Year 6 students:
• apply knowledge gained from one context to another unrelated context and apply new meaning (for example considering the meaning of change as it is used in science compared with its meaning in history)

By the end of Year 10 students:
• construct systematic plans to transfer ideas and trends between different scenarios (for example looking for patterns and integrating various topics into one problem)

Generating innovative ideas and possibilities

Imagining possibilities and considering alternatives

By the end of Year 2 students:
• create new ideas by linking what they know in imaginative and original ways (for example considering whether it is possible for a person to be taller and shorter than you at the same time) identify main ideas and clarify meaning in information (for example examining themes in texts or images)
• explain or demonstrate ideas in a variety of ways to help others’ understanding

By the end of Year 6 students:
• create analogies by matching two ideas in context (for example using unusual or unexpected combinations of ideas to create new possibilities) explain or demonstrate ideas in a variety of ways to help others’ understanding
• use a range of visualisation strategies to challenge and investigate possibilities (for example diagrams, mindmapping)

By the end of Year 10 students:
• draw parallels between known and new scenarios, and use ideas, patterns and trends to consider new possibilities (for example developing hypotheses based on known models and theories)
• represent explanations and ideas by using imagery and symbolism to communicate creative ideas to others

Seeking and creating innovative pathways and solutions

By the end of Year 2 students:
• think imaginatively – asking ‘What if ...?’ to generate unusual responses to a problem (for example What if a person understood the language spoken by everyone?) compare and contrast points identified within information
• look for new patterns and connections within information in familiar situations (for example mapping connections between events in texts)

By the end of Year 6 students:
• create analogies by matching two ideas in context (for example using unusual or unexpected combinations of ideas to create new possibilities) explain or demonstrate ideas in a variety of ways to help others’ understanding
• use a range of visualisation strategies to challenge and investigate possibilities (for example diagrams, mindmapping)

By the end of Year 10 students:
• predict possibilities and envisage consequences when seeking new meanings (for example pursuing an unexpected result or several solutions in an inquiry)
• speculate on possible options and outcomes, and modify responses to concrete and abstract ideas (for example developing ideas for further investigation based on past experiences)

Suspending judgment to visualise possibilities

By the end of Year 2 students:
• consider alternative actions to given situations (for example exploring problems identified in learning areas and ways of overcoming them)

By the end of Year 6 students:
• recognise there are multiple choices for solving a problem and imagine outcomes of these possibilities (for example generating and building on varied possible solutions to a problem that affects their lives)

• engage in challenging situations, and persist with generating new approaches when initial ideas do not work (for example persisting with an idea when conducting an investigation and seeing ‘failures’ as challenging)

**By the end of Year 10 students:**

• temporarily suspend rational thinking to allow new possibilities to emerge (for example expressing, in other forms, ideas or concepts that cannot be expressed in words)

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**Reflecting on thinking, actions and processes**

**Reflecting on thinking**

**By the end of Year 2 students:**

• with support, identify and describe thinking and learning strategies they have used (for example deciding the best strategy for solving a problem)

• describe their thinking in terms of personal feelings and concerns

**By the end of Year 6 students:**

• independently reflect on their thinking, consider reasonable criticism and adjust thinking if necessary (for example identifying where methods of investigation and inquiry could be improved)

• form personal theories, paraphrase and construct analogies or similes to explain their thinking

**By the end of Year 10 students:**

• give reasons to support their own thinking, show awareness of opposing viewpoints and possible weaknesses in their own positions (for example comparing justifications for approaching problems in certain ways)

• set personal goals for further development of critical and creative thinking

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**Reflecting on procedures and products**

**By the end of Year 2 students:**

• reflect on whether they have accomplished what they set out to do (for example Did they listen well to a peer’s answer?)
By the end of Year 6 students:
• explain and justify actions and solutions against identified criteria (for example examining their own and peer responses to an issue)

By the end of Year 10 students:
• evaluate the effectiveness of possible solutions and implement improvement to achieve desired outcomes (for example evaluating the strength of a conclusion, identifying alternative solutions consistent with evidence)

Analysing, evaluating and synthesising information

Applying logical and inventive reasoning

By the end of Year 2 students:
• consider and choose information that is relevant to understanding given situations or issues (for example distinguishing between what is ‘real’ and what is imagined in texts).
• identify the details of a whole task and separate it into workable parts (for example sorting information in graphs and graphic organisers)

By the end of Year 6 students:
• identify gaps in knowledge and missing elements in information, seek further information to make improvements and use evidence to test propositions (for example assessing whether there is enough evidence to make a particular claim)
• choose pertinent information from a range of sources and separate this information into smaller parts or ideas (for example examining sources of evidence to identify similarities and differences)

By the end of Year 10 students:
• analyse the means and resources available for finding solutions (for example testing propositions to identify reliability of data and faulty reasoning)
• balance rational and irrational components of a complex or ambiguous problem to evaluate evidence (for example exploring attitudes to changing patterns of social groupings)

Drawing conclusions and designing a course of action

By the end of Year 2 students:
• recognise a problem and explore possible pathways for reaching a conclusion
• consider alternative courses of action when presented with new information (for example asking how an outcome would change if a character acted differently)

By the end of Year 6 students:
• draw on prior knowledge and evidence to formulate solutions to a problem
• use concrete, pictorial and digital models to check reasoning and modify actions accordingly (for example using graphs, charts, visuals to chart progress of an action/argument and propose alternatives)

By the end of Year 10 students:
analyse and synthesise complex information to draw conclusions and inform a course of action (for example using primary or secondary evidence to support or refute a conclusion)