



CREATIVE THINKING: SKILL DEVELOPMENT FRAMEWORK

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1

INTRODUCTION

In recent years there has been an increasing recognition that creativity and creative thinking should be fostered as valued outcomes of schooling, either in their own right, or as part of a set of so-called '21st-century skills' (Partnership for 21st Century Skills 2009; Griffin & Care, 2012; Kereluik et al., 2013; Adams et al., 2015). While the importance of creative thinking is now widely accepted, it remains the case that there is no agreement regarding a definition of creative thinking, nor is there a universally adopted framework to guide its teaching and assessment. It is in this context that ACER has reviewed the extensive literature on creative thinking and developed a skill development framework that synthesises and harmonises existing theory and research on creative thinking. This framework has been developed to address the challenges associated with teaching and assessing creative thinking. It outlines creative thinking processes along prescribed *strands* and *aspects* informed by a sound evidentiary basis. The aspects contained within the framework are designed to provide foci for teaching and the basis of assessment.

ACER's framework focuses on creative thinking rather than creativity. Some of the reasons for this are:

- creative thinking underpins creative output
- creative thinking strategies can be taught
- it is possible to focus on creative thinking as the key element in a task, whereas creativity tends to involve a hybrid set of skills.

ACER's creative thinking framework identifies key factors that underpin the development of creative thinking with a focus on observable skills and teachable creative thinking strategies. A main aim of this framework is to support the development of standardised assessments that can be delivered in the classroom and in doing so, support teachers in developing and evaluating learners' creative thinking skills.

As a teaching and assessment resource, the ACER creative thinking skill development framework presented in the subsequent section seeks to describe creative thinking as a generally applicable set of skills, and as it tends to be operationalised in practice. The skill development framework describes creative thinking in a general way providing a consistent terminology: however, in order to apply, teach, and assess the skill it needs to be embedded within learning areas. The skill needs to be embedded within the methodologies, conventions and 'ways of knowing' of each of the disciplines to give their application context, to ensure they are relevant, and that they can be sustainably integrated. A benefit of the framework is having consistent terminology in which to describe the skill and its associated aspects across learning areas. The aspects can be used to write or map assessments items, or the aspects can be integrated into lesson plans.

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CREATIVE THINKING – A SKILL IN NEED OF A DEFINITION

Given the heightened interest in creative thinking and broad acceptance of its importance, it is striking that as Lucas (2016) has identified, not only is there no accepted definition of creative thinking, but consequently, there is no commonly agreed framework to guide its assessment. This has led to a situation in which many frameworks of skills deemed necessary for the 21st century exist but teachers were left unsure of how they should be implemented (Vincent-Lancrin, 2017).

In part, this lack of consensus is the result of different disciplines bringing their different assumptions and ideas to the study of creativity. Banaji et al. (2010) identified a large number of competing rhetorics that existed in relation to the idea of creativity, for example, the ideas of the creative genius, creativity as a social good, and creativity as an economic imperative, among others.

Some common ground on the key features of creative thinking

It is reassuring to note that despite the lack of a consensus on a definition of creative thinking, several meta-analyses (e.g. Plucker & Beghetto, 2004; Treffinger et al., 2002) suggested there was common ground on its key features. Abdulla and Cramond (2017) reviewed more than 40 assessment instruments. They maintained there were two elements to most definitions, which they labelled 'originality' and 'usefulness'. This broad categorisation has been reiterated by numerous researchers (e.g. Jackel, 2015; Starko, 2010) and finds expression in several influential definitions. For example, Sternberg and Lubart (1999) defined creativity as the 'ability to produce work that is both novel and appropriate', and Plucker et al. (2004) defined creative potential as 'the interaction among aptitude, process and environment by which an individual or group produces a perceptible product that is both novel and useful within a social context' (p. 90). These two aspects of creativity are also emphasised in policy documents. For example in their 2009 literature review, Ferrari et al. argued that creativity is 'a product or process that shows a balance of originality and value' (p. 19). These two accepted aspects of creativity were the starting point for ACER's definition of creative thinking.

3

CREATIVE THINKING IN EDUCATION

With the widespread acceptance of the importance of creative thinking in education has come a move to explicitly enshrine its central role in school curricula. In Scotland, for example, 'Creativity is very clearly at the heart of the philosophy of Curriculum for Excellence and is fundamental to the definition of what it means to be a "successful learner" in the Scottish education system.' (Education Scotland, 2013, p. ii). In Australia, there has been an emphasis for some time on developing 'successful learners, confident and creative individuals, and active and informed citizens' (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008, p. 8). More recently, critical and creative thinking has been included as a general capability in the Australian

curriculum (ACARA, n.d.), and the Gonski report listed the need to 'equip every child to be a creative, connected and engaged learner in a rapidly changing world' as a priority (Department of Education and Training, 2018, p. 5).

The focus on creative thinking in education has some support in research. Proponents of the paradigm of positive psychology (e.g. Seligman & Csikszentmihalyi, 2000) argued that creativity has the potential to improve quality of life. Robinson (2001) suggested that 'naturalist' models of education, which assumed that drawing out aspects such as feelings and creativity were as critical as formal academic domains, and are sorely needed in the context of a changing world. Hattie (2009) also found evidence that the teaching of specific creativity programs has a positive influence on achievement.



THE LONG HISTORY OF THE ASSESSMENT OF CREATIVE THINKING

Despite the lack of a consensus definition, the assessment of creativity has a long history, as different groups of researchers approached the problem using their own definitions (Hocevar, 1981). In the 1950s, psychologist J.P. Guilford was one of the first researchers to suggest the value of the formal measurement of creativity (Guilford, 1950). Guilford formulated the notion of divergent thinking (DT), defined as the ability to generate multiple solutions to an open-ended problem. DT contrasts with convergent thinking, which involves tasks that have only one correct answer. Measurements of DT became the dominant vehicle for assessing creativity in the second half of the 20th century. The Torrance Tests of Creative Thinking (TTCT) (Torrance, 1966), for example, are based on this idea, and are still widely used today.

Researchers later began to explore broader issues, such as the relationship of creativity to other traits such as intelligence and problem-solving, (e.g. Sternberg, 1997); the role of context (e.g. Amabile, 1982); and the role of domain knowledge in creativity (e.g. Csikszentmihalyi, 1988). Despite the fact that several such broad issues are still the subject of debate, there have been numerous attempts to assess creativity. Plucker and Makel (2010) argued that assessments of creativity fall into the following categories:

- assessments of DT
- assessments of creative personality
- activity checklists of experience associated with creative production
- attitudinal scales
- assessment of creative products.

Not all of these categories of assessment would be useful in an educational setting. Indeed, Henriksen et al. (2015) noted that in their review of 85 instruments for measuring creativity, nearly half were designed for adults, and very few were based on evaluating a creative product. This shortcoming means that although there is a great deal of interest in the assessment of creativity within schools, there is currently little

consensus on what assessment approaches and tools might be used to achieve this goal. There are, however, some existing frameworks that have been used in educational settings, which might be used to guide future attempts.

The Programme for International Student Assessment (PISA) is a triennial assessment administered by the Organisation for Economic Co-operation and Development (OECD). In every PISA cycle, the core domains of reading, mathematics and science are assessed, with one of these three designated as the major domain that forms nearly two-thirds of the content for that cycle (OECD, 1999, p. 10). However, in most cycles, additional, optional, cognitive assessments have been available. In PISA 2021, an assessment of creative thinking will be included (Lucas, 2017), a sign of the interest in, and focus on creative thinking, strong enough that will be included in one of the best-known, large-scale international assessments.

At the time of writing, only a draft framework for this domain was available. For the purposes of PISA, creative thinking is defined as ‘the competence to engage productively in the generation, evaluation and improvement of ideas, that can result in original and effective solutions, advances in knowledge and impactful expressions of imagination’ (OECD, 2019, p. 7). The assessment will focus on two broad areas: creative expression, and knowledge creation and creative problem-solving. These areas will then each be subdivided into two domains (creative expression into written expression and visual expression, and knowledge creation and problem-solving into scientific problem-solving and social problem-solving). For measurement purposes, three facets of creative thinking are also defined: generate diverse ideas, generate creative ideas and evaluate and improve ideas (OECD, 2019).

5 ACER'S DEFINITION OF CREATIVE THINKING

While the review of definitions of creativity in an earlier section suggest there are several issues relating to creativity that are yet to be resolved by researchers, there is a consensus that creativity involves both originality and usefulness. To be seen as creative, a product must be novel (within contextual constraints) and it must be fit for purpose. This consensus, along with an aim to focus on aspects of creative thinking that are amenable to assessment, teaching and learning, was the starting point for ACER's definition of creative thinking.

The fundamental assumptions about creative thinking that underpin ACER's definition are that:

- it can be learned (Claxton, Edwards, & Scale-Constantinou, 2006)
- it is important for successful participation in 21st-century life (Robinson, 2001)
- it contains both domain-specific and domain-general aspects (Craft, 2008; Lassig, 2013).

Additionally, since ACER's definition is considered within the context of teaching and assessing the skill, there must be an end goal: that there is purpose and necessity to employing the skill.

ACER's definition of creative thinking is:

Creative thinking is the capacity to generate many different kinds of ideas, manipulate ideas in unusual ways and make unconventional connections in order to outline novel possibilities that have the potential to elegantly meet a given purpose.

This definition is unpacked below.

Creative thinking is the capacity to generate many different kinds of ideas...

Creative thinking is mainly concerned with process. Creative thinkers are able to generate many different ideas and consider things from a wide range of perspectives, including unusual perspectives. Creative thinkers avoid premature closure. They are able to canvas a broad field of possible ideas and resist excluding unlikely seeming ideas too early in the process.

The strong research tradition of assessing creativity through DT (e.g., Guilford, 1950; Torrance, 1966) has focused on generating a wide diversity of ideas. Both the quantity of different kinds of ideas and their originality are important. The quantity matters, as many ideas that may seem ordinary may subsequently be manipulated or combined in novel ways. Unusual ideas and perspectives also matter as seeing things in very different ways from most other people is a hallmark of creative thinking.

... manipulate ideas in unusual ways and make unconventional connections...

Creative thinking takes ideas from one context and applies them in an unexpected context or subverts or twists them in previously unimagined ways. Creative ideas are unexpected and may even seem outrageous or absurd. They typically challenge conventional ways of thinking about a problem, an artefact or an experience. There may be an element of surprise in a creative idea.

... in order to outline novel possibilities that have the potential to elegantly meet a given purpose.

Creative thinking is purposeful and controlled. It is not simply giving free rein to a wild and fanciful imagination with no reference to any kind of reality. Creative thinking takes place within the constraints of a task such as a problem requiring a solution or a new product or form of artistic expression or experience that needs to be realised within practical constraints and aesthetic considerations.

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ACER'S CREATIVE THINKING SKILL DEVELOPMENT FRAMEWORK

The assessment of creativity and creative thinking has typically been characterised in relation to the '4Ps' first identified in the 1960s (Rhodes, 1961). These 'Ps' are the person (personality features and dispositions of an individual), the process (the observable learning and thinking involved in a creative act), product (the end result), and press (the environment, including social factors). Researchers have tended to focus on one, at most, two of these aspects, and in doing so, align themselves with a particular research tradition, and manner of conceiving of creative thinking. ACER's model has a focus on the process of creative thinking, and the end product, with the knowledge that these features are observable and amenable to being measured using new techniques for standardised assessments that can be easily administered in the classroom.

In addition to having a different focus from some of the other frameworks reviewed, ACER's construct of creative thinking attempts to overcome the shortcomings of previous frameworks, most notably that they do not contain a sufficiently elaborated definition of creative thinking, or, where critical and creative thinking are combined, there is insufficient emphasis on the latter (ACARA, n.d.; Victorian Curriculum and Assessment Authority, 2018).

ACER has defined creative thinking according to overarching strands, which are key skills or ideas that support creative thinking, and within that, aspects, which define how the strands might be assessed. ACER's creative thinking construct consists of three strands, including seven aspects in total, as depicted in Figure 1.

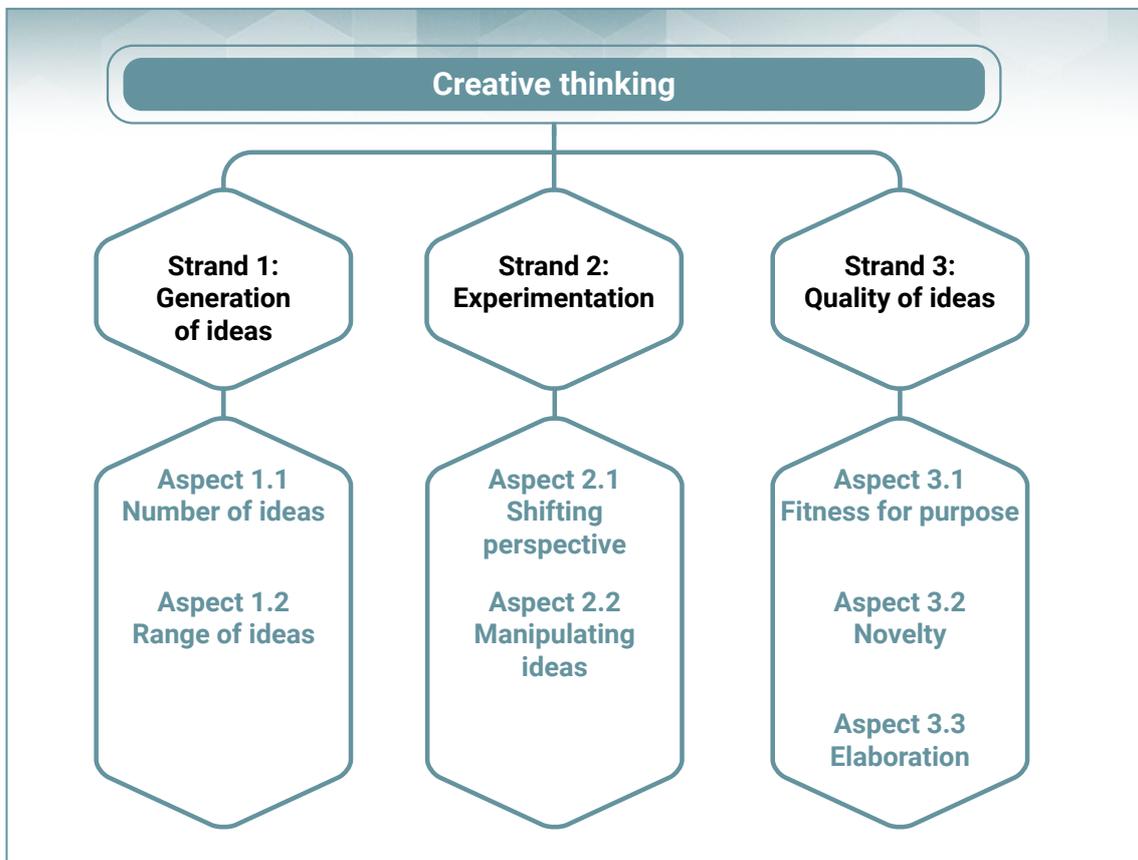


Figure 1 ACER's creative thinking skill development framework

Strand 1 Generation of ideas

Creative thinking is, at its core, a generative process. This strand acknowledges the importance of the production of many different ideas, sometimes called ideational fluency (Guilford, 1950) to the process of creative thinking.

Aspect 1.1 Number of ideas

The research tradition of assessing creative thinking, in part, by a simple count of the number of ideas generated is extremely strong (e.g. Guilford, 1950; Torrance, 1966), and this idea is explicitly present in at least one of the frameworks earlier reviewed ACARA (n.d.) (and arguably, implicitly, in others). While this aspect cannot speak to the quality of the ideas produced, the generation of ideas is a prerequisite for developing a creative solution. The inclusion of this aspect recognises that the more ideas are produced, the more likely it is that a truly creative idea will be among them. When a large number of ideas is produced, one or more could be combined to construct a creative product. While some researchers have argued that generation of ideas may be a domain-specific, rather than domain-general aspect of creative thinking (e.g. Han, 2003), it is likely to be possible to improve this issue by assessing creative thinking within more than one domain.

Aspect 1.2 Range of ideas

The notion that if a greater number of ideas is produced it is more likely that a creative one will be among them relies on the belief that distinct ideas will be produced. If many ideas are produced, but they share fundamental similarities, it is likely that the level of creative thinking exhibited by each idea will be similar. Likewise, if a number of similar ideas is produced, it is less likely that they will be combined or synthesised to form a new idea or solution. This aspect explicitly addresses the number of *distinct* ideas presented. The concept of assessing both the number of ideas, as well as the number of different categories represented in a set of ideas was represented in the early, seminal work of Guildford on DT, and largely remains present in the modern forms of such assessments (Plucker & Makel, 2010), so has an established research history.

Strand 2 Experimentation

A key element of creative thinking is the ability to 'play' with ideas, both previously existing, and newly-generated. Critical to this process are the ability to consciously consider ideas from multiple perspectives, and to think creatively within the constraints of a task. This can lead to 'new' ideas in the form of processes such as adaptation and synthesis (Lassig, 2013).

Aspect 2.1 Shifting perspective

Creative thinking necessarily occurs within the constraints imposed in order to meet the purpose of the task. A challenge of creative thinking is to think flexibly enough to find novel ways to move within the constraints. However, we often constrain ourselves more than necessary. Creative thinkers consciously shift their own perspective of a

problem in order to redefine the problem's context, and therefore come up with new ways to approach attempts to find a solution. A hallmark of creative thinking is that such perspective shifting is unconstrained by the conventional uses of objects or typical perspectives on ideas present in the problem context. In this way, creative thinkers act to overcome a form of cognitive bias called functional fixedness (Duncker, 1945) in which individuals only look at a problem from one perspective and simply do not see other possibilities.

The notion of being able to think creatively about the boundaries of a task, and how they might be moved, shifted or changed is reflected in the common phrase that creative thinking involves 'thinking outside the box'. Creative thinkers who demonstrate the ability to shift perspective typically ask 'what if' questions to renegotiate the boundaries of the known constraints of the problem context, and thereby open up new possibilities.

The willingness to actively shift perspective and consider new ways of seeing a problem is at least in part, related to disposition, since it involves an ability to suspend judgement, and tolerate uncertainty. Creative thinking may require individuals to keep an open mind, be willing to experiment and to consider and explore possibilities that may initially seem hopeless. Creative thinkers are willing to contemplate what may seem impossible and follow unlikely paths. This notion was directly reflected in Lucas' (2016) Habits of Mind model, in which persistence is one of the five core creative habits.

While critical thinking and collaboration each also contain a notion of acknowledging other perspectives, this is generally in relation to identifying and addressing gaps in knowledge. In creative thinking, however, the ability to be flexible and see things from a different perspective is about seeing information that is already known, in new ways.

In order to think creatively, learners need to learn how to push the boundaries of a task to maximise the amount of creative thinking space. Conscious shifts in perspective can allow us to identify what aspects of a task can be changed. The notion of being able to shift our own perspectives is explicitly present in the framework proposed by ACARA (n.d.) as 'considering alternatives', and implicitly present in the Habits of Mind model as challenging assumptions and playing with possibilities (Lucas, 2016).

Aspect 2.2 Manipulating ideas

Manipulating ideas requires flexible thinking. Creative thinkers know how to manipulate the elements of a task or prompt in different ways to generate new ideas. They combine, subvert, twist or graft elements together in unlikely ways to open up new possibilities and radically different ways of thinking about something. This aspect is implicitly present in the Habits of Mind model as exploring and investigating and playing with possibilities (Lucas, 2016). More generally, the inclusion of this aspect is an clear acknowledgment that creative thinking often involves adaptation or synthesis of existing ideas, rather than the generation of entirely new ones, a notion which is well-supported by research (e.g. Lassig, 2013).

Strand 3 Quality of ideas

Creative thinking does not exist in a vacuum. This aspect is about ensuring that the ideas generated are of high quality. Examining the appropriateness (or otherwise) of a solution is an idea that is present in most of the frameworks reviewed. The work of ACARA (n.d.) refers to 'seeking solutions and putting ideas into action'. Both the P21 framework and the ATC21S framework contain a similar idea, of implementing innovations (Binkley et al., 2012; Partnership for 21st Century Learning, 2015). A strength of the ACER approach is that not only is the importance of the solution as a creative product acknowledged, but the key features of a product that demonstrates creative thinking are specified.

Aspect 3.1 Fitness for purpose

While definitions of creativity are contested, there is fundamental agreement that it includes the notion of the end result being fit for purpose. Influential definitions have used the words 'appropriate' (Sternberg & Lubart, 1999, p. 72) and 'useful' (Plucker et al. p. 91, 2004) to express this idea. Fundamentally, this aspect acknowledges that creative thinking has a purpose, and if the end product is of no value, then it does not fully demonstrate creative thinking.

Aspect 3.2 Novelty

The idea that a creative product must be new is also fundamental to agreed definitions of creativity (Plucker et al., 2004; Sternberg & Lubart, 1999). In the context of educational assessment, this key aspect remains important, but qualification is necessary. It is unlikely that learners will generate an idea that is truly new, in the sense of it never having been generated before. As Smith and Smith (2010) have noted, however, an idea that is new to a learner, even if not new in an absolute sense, can still be considered creative.

Generating novel or original ideas is relative to, and dependent on, the social context. For example, a learner may generate ideas that are highly unusual in comparison with their classmates', but they may be similar to ideas generated in a different class. Ideally, learners can work in a context in which the evaluation of the novelty or originality of an idea is generous enough that it provides opportunities for success while also challenging learners to think differently.

This idea is of special importance in the case of young learners, who have limited experience of the world and, consequently, a different perspective on what might constitute novelty. Many ordinary ideas may seem new in their eyes. They may also generate some ideas that are truly novel, with little capacity to differentiate these from commonplace ideas. Supporting creative thinking for young learners will usually involve providing opportunities for experimentation and risk-taking with the teacher modelling the explicit valuing of unusual responses.

Aspect 3.3 Elaboration

Elaboration of an idea is about illustrating the richness of its potential to meet a given purpose. It may require providing detail when an idea might initially seem far-fetched in order to explain how it could potentially be effective. Elaboration gives substance to an idea, and acts to support its fitness for purpose.

While the level of detail in a response has not tended to be included in more recent frameworks, its importance was acknowledged in early work, with elaboration included as one of the response

Levels of skill development are used to describe how growth in a particular area can be demonstrated, and how learners move from early to more measures in the influential work of Guilford (1950).

7 SKILL DEVELOPMENT LEVELS

ACER's perspective of skills in the application of knowledge is centred on and emphasises the notion of growth. Skills can be defined from a growth aspect, can be improved through teaching and intervention, and are measurable. Levels of skill development are used to describe how growth in a particular area can be demonstrated, and how learners move from early to more advanced application and understandings. These levels are focused on assessing and monitoring learner growth over time, and are underpinned by an understanding that learners of the same age and in the same year of school can be at very different points in their learning and development. Therefore, the levels are not linked to specific years of schooling. Assessments provide information about where learners are in their understanding at given points in time and they also provide a basis for monitoring individual progress over time. Assessments of progress are an alternative to judging success only in terms of year-level standards.

While progress can be described in a general way, for example what a highly proficient creative thinker demonstrates compared to a less proficient creative thinker, the application of the skill still depends on the domain context. The level of application in one learning area will not necessarily transfer equally to another learning area.

The ACER skill development levels for creative thinking are provided in Table 1. They are intended to support understanding of the skills and the ways in which they develop. They can also support teachers to identify gaps in a learning area, where some learners may require further assistance. To ensure an evidence-based approach, these levels have been, and continue to be validated and corroborated through comparison of assessment data.

Table 1 Skill development levels of creative thinking

	Generation of ideas	Experimentation	Quality of ideas
	<p>Aspect 1.1 Number of ideas</p> <p>Aspect 1.2 Range of ideas</p>	<p>Aspect 2.1 Shifting perspective</p> <p>Aspect 2.2 Manipulating ideas</p>	<p>Aspect 3.1 Fitness for purpose</p> <p>Aspect 3.2 Novelty</p> <p>Aspect 3.3 Elaboration</p>
High		<p>Learners demonstrate a willingness to experiment, shifting beyond conventional perspectives leading to new possibilities. They question and renegotiate the boundaries of the task to navigate around possible constraints. They test out multiple pathways, even those that seem unlikely. (Aspect 2.1)</p> <p>Learners think flexibly to manipulate elements of the task. They effectively combine elements of a task to allow new possibilities or a different way of thinking about the task. (Aspect 2.2)</p>	<p>Learners develop some original ideas containing concepts less familiar to them beyond their social context. (Aspect 3.2)</p> <p>Learners present ideas that are effective and coherent, fluent and well-elaborated. The elaboration of ideas is substantive, addressing their effectiveness and justifying fitness for purpose. (Aspect 3.3)</p>
Mid High	<p>Learners provide many ideas. (Aspect 1.1)</p> <p>Learners provide a range of ideas that are distinct from one another. (Aspect 1.2)</p>	<p>Learners can shift perspective, thinking about the task/problem in a different way and considering the task/problem from a range of conventional perspectives. They are willing to test out an alternative pathway. (Aspect 2.1)</p> <p>Learners demonstrate some evidence of experimentation, manipulating some of the task elements, or synthesising existing ideas. (Aspect 2.2)</p>	<p>Learners' elaboration of ideas attempts to evaluate effectiveness, and/or justifies fitness for purpose. (Aspect 3.3)</p>
Mid	<p>Learners provide a small number of ideas. (Aspect 1.1)</p> <p>Learners' ideas represent a range of themes. (Aspect 1.2)</p>	<p>Learners' manipulations are mainly routine, limiting exploration to obvious elements of the task, and revisiting the same ideas, rather than generating new ones. (Aspect 2.2)</p>	<p>Learners present ideas that are both practical, and likely to be effective. (Aspect 3.1)</p> <p>Learners present ideas that are obvious or conventional and contain concepts that are already familiar to them. (Aspect 3.2)</p> <p>Learners elaborate their ideas, but without an evaluation of effectiveness, or justification in relation to fitness for purpose. (Aspect 3.3)</p>
Low	<p>Learners provide a limited range of ideas all focusing on the same theme. (Aspect 1.2)</p>	<p>Learners view the task through their single perspective without consideration of what task elements can be changed, or considering alternative perspectives or pathways. (Aspect 2.1)</p> <p>Learners' manipulations of the task elements are limited. (Aspect 2.2)</p>	<p>Learners present ideas that are either practical, or likely to be effective, but not both. (Aspect 3.1)</p> <p>Learners develop their ideas in a limited way without elaboration. (Aspect 3.3)</p>

8

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