# Chapter 16 Tools for creativity

## Introduction

When tackling a problem and attempting to come up with a creative solution or come to a decision, you may find yourself doodling on a sheet of paper or drawing diagrams and making lists of pros and cons. In a group situation you may hear people say, 'We need to brainstorm about this.' These are all examples of 'tools' that can be used to assist problem-solving and to enhance creativity.

After an initial brief survey of the genesis of creativity tools, this chapter describes a representative sample of methods that have been developed and how they might be used in the classroom. Problematic aspects of some tools are also touched upon.

## Genesis

Specific creativity tools were developed as part of a widespread twentieth-century belief that there could be a rational approach to thinking creatively that could be encapsulated in a series of techniques. Notwithstanding the awareness that the current attitude to creativity techniques is now more contextual and nuanced, these techniques are still very much in use. Terms like 'brainstorming' (Osborn 1953); 'mind maps' (Buzan 1977) and 'lateral thinking' (de Bono 1970) have now entered everyday language. These tools were much promoted for commercial ends, resulting in a range of books, products and courses concerned with practical techniques for coming up with ideas to solve problems or create innovative products. These are popular examples of a wide range of creativity and problem-solving tools which have migrated from the worlds of psychology, business and advertising to that of education.

This transfer became very apparent the middle of the twentieth century, particularly in the USA when a necessity for creativity was associated with meeting 'the challenge of accelerating changes of an unprecedented magnitude' arising from 'scientific discovery, technical invention, commercial competition and military rivalry' (Pope 2005: 19). Just as the attempt to use computers to model human thinking led to thinking being conceptualized as a form of data processing (Jordan et al. 2008: 37), the view that creativity can be a means of accelerating technical solutions led to the reciprocal idea that technical solutions can be a means of accelerating creativity. This also linked in neatly with a systems approach to problem-solving and to thinking, encouraged by the development of computers and the technical-rational approach to problem-solving at about the same time.

Guilford is credited in his 1950 *Presidential Address to the American Psychological Association* with highlighting the close link between creativity and learning. Guilford argued that 'We are in a mortal struggle for the survival of the world, the



military aspect of this struggle with its race to develop new weapons and strategies has called for a stepped-up rate of invention' (Pope 2005: 20). Torrance subsequently developed the Torrance Tests of Creative Thinking (TTCT) which are still widely used in creativity testing (Smith and Smith 2010: 252). These tests are discussed in Chapter 9.

In the educational world, creativity and learning became increasingly merged, and then linked to the development of study skills, problem-solving and metacognitive strategies. A simple Google search will provide a wide range of sites offering general creativity and problem-solving techniques while King (2002: 137–40) contains a list of software and websites specifically suited to postgraduate research.

However, whereas in industry the tools were used to achieve particular ends, in education they often became enshrined in curricular programmes with a discrete identity. Here they were codified and structured, and linked with thinking skills, study skills and memory techniques, to create 'stand-alone' thinking programmes which could then be applied across the board. This is an inevitable consequence of creativity being 'tamed' by an educational setting, so that it fits into the 'system' of curricular programmes, subjects, classrooms and timetables.

The idea that general thinking skills can be transferable across different domains is challenged by John White (2004). Such decontextualized creativity techniques have had limited success in education because they are not embedded within subjects and disciplines. A modern view sees creativity as contextual in relation to particular values, social demands and purposes which would vary in different disciplinary areas where subjects have their own 'threshold concepts' (Meyer and Land 2003), requiring subject-specific epistemologies and techniques. For example, brainstorming – a technique for generating many ideas – is potentially useful in developing *divergent* ideas such as in advertising. It would be far less useful where *convergent* thinking is required, such as in a court of law.

So: tools of creativity are products of a late twentieth-century educational paradigm that values a rational approach, practical techniques and measurable outcomes. This philosophy is played out elsewhere in education in the popularity of learning outcomes, learning styles and multiple intelligences. Despite the limitations of the artificial lack of context, a technical approach to creativity has an obvious attraction for teachers who like to see themselves as not merely imparting knowledge but helping learners to take responsibility for their own learning.

We consider that education is by its nature decontextual, and needs general tools to be used in a classroom without sustained reference to purposes, values or context. A technical rational approach to creativity makes the assumption that creativity is a problem-solving process. This makes it ideally suited to the educational endeavour because such a process is teachable. This approach does not 'chime' with creative individual geniuses such as Einstein who are in the realm of 'Big C' and do not only solve existing problems, but pose new, hitherto unconsidered ones. Although these creative people are beyond the reach of education, the tools of creativity attempt to model their behaviour in an artificial way.

Therefore, despite the contested nature of their effectiveness and relationship to creativity, these tools can still be useful in the classroom. We now describe a

representative number of techniques as exemplars that can be used to assist in the attempt to generate and evaluate creative and novel ideas in an educational setting.

## Stage approach to creativity

Many approaches to creative thinking such as TRIZ (Altschuller 2001) and Geneplore stress the idea of components or stages. TRIZ is a complex and highly structured approach which involves selecting suitable approaches distilled from patterns noted in patents. Altschuller used a form of reverse engineering to identify common patterns from thousands of patents, which led to 40 principles of invention. If a specific problem can be framed in a generic way, then the TRIZ tool can be employed to come up with creative ideas (Puccio and Cabra 2010: 162). It has been used in education by undergraduate students in design technology, computing technology and product design.

The Geneplore descriptive framework (Finke et al. 1992) suggests that creativity results from a combination of generative processes that produce ideas, and exploratory ones that expand and develop them. One useful way to categorize thinking tools, therefore, is in terms of the stage of the creative process to which they might be best suited. The teacher can provide learners with strategies or tools appropriate for different stages:

1. Assumptions and attitudes.
2. Conceptualization.
3. Creation of ideas.
4. Exploration of ideas.
5. Evaluation of ideas.

Assumptions and attitudes form a context for all the stages of the process, and the movement from conceptualization to creation of ideas involves divergent thinking (Guilford 1950), which produces multiple ideas to be explored. After the exploratory Stage 4 a convergent phase of evaluation leads to the narrowing down of the possibilities to the one that is actually implemented. These stages are illustrated in Figure 16.1.

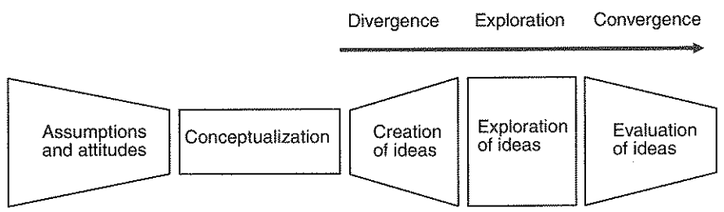


**Figure 16.1** Stages of the creative process



## Assumptions and attitudes

Assumptions are notions which are taken for granted and not questioned. Students have all sorts of assumptions that go without saying. For example, they may have the assumption that school is a place where the teacher has all of the knowledge and responsibility for learning and will always have the correct answer. Attitudes are manifestations of assumptions which are their intellectual backdrop, so the above assumption may lead to a passive attitude on the part of the pupil.

Assumptions and attitudes form a contextual backdrop to the creative process. In teaching students how to apply creativity tools, the first issue that the teacher needs to address is the assumptions and attitudes that learners have towards creativity. One can have all the necessary tools, but without the appropriate attitude one may not be inclined to make use of them. Furthermore, as discussed in Chapter 6 on creativity and culture, attitudes are open to the influences of cultural context, history, parents and peers that are far stronger, pervasive, older and longer-lasting than the school (Bronfenbrenner 1979). Thus there are great difficulties for a teacher in accessing and causing attitudinal change in learners. However, attitudes do not simply precede behaviour; they are embedded in behaviour and are changed by it (Bandura 1977). Thus attitudinal change may occur as a result of a change in behaviour rather than the other way around. For example, school rules that insist upon punctuality may lead students to develop an attitude that values timekeeping. A teacher may take a behaviourist approach which accepts that assumptions and attitudes are inaccessible, but seeks instead to shape behaviour by using a range of creativity tools that scaffold creativity. Learners who are taught how to use tools to produce results that are patently creative may go on to develop an attitude that recognizes the possibility that they could be creative.

According to Claxton (2002), one of the important 'individual learning dispositions' of creative individuals is resilience. In a classroom situation, many learners will fear ridicule from their classmates, so resilience is necessary in order for creative people to have sufficient self-confidence to share their ideas without fear of rejection. Tools of creativity artificially create conditions that mimic resilience by offering a safe space where the expression of creative ideas is expected and legitimized.

### Provocative operation

In the conceptualization of a problem there may be a necessity to challenge assumptions in order to permit a more creative solution. A tool that systematically challenges assumptions is called Provocative Operation (PO) (de Bono 1996: 131). De Bono has been at the forefront of many ideas in developing thinking tools – in the business and educational fields – and many of the following tools are attributable to him. While PO stands for **p**rovocative **o**peration, de Bono suggests other derivations relating to hy**po**thesis, **po**ssible, supp**o**se or **po**etry, showing that the idea may be extended to many alternative possibilities.

In a classroom situation the teacher can tell the class that the word 'PO' can be used in three ways, as shown in Table 16.1.

**Table 16.1** Three ways of using PO

| | Use | Intention |
|---|---|---|
| 1 | PO makes an idea immune from ridicule or dismissal | Permit an apparently silly idea to be developed into a good one |
| 2 | PO allows two random ideas to be placed together | Permits unlikely combinations that would not normally be considered |
| 3 | PO challenges the attitudes and assumptions of the status quo | Provokes change |

*Example*

Consider how a class might think creatively about the issue of school attendance, applying the three ways of using PO described in Table 16.1.

1. 'PO: students should be forced to stay away from school':
   - distance learning, web-based learning, learning by text;
   - students must earn the right to come to school.
2. 'PO: school attendance cardigan':
   - children may have some uniform feature indicating attendance level;
   - uniforms have bar-code that can be monitored for attendance.
3. 'PO: why is school attendance necessary?'
   - What is special about being present?
   - How is group collaboration used?
   - What parts of learning require attendance and what parts do not?

In practical use, PO needs extensive preparatory work. Students are used to conformity, and the usual work in a classroom is opposed to ridiculousness and randomness. It is not surprising that students are taken aback if the technique is suddenly 'sprung' on them without preparation.

### Opposites and distortions

In order to come up with new ideas learners' assumptions may need to be challenged. In using this tool a teacher can get learners to articulate their assumptions and then challenge each assumption in a systematic way:

*Opposites* The opposite of each element is examined
*Distortion* Elements are magnified, minimized or altered

Creative alternatives could be developed using other tools discussed later.



*Example*

Typical orthodox assumptions about a classroom include the ideas that it:

- is in a building;
- occupies a discrete space;
- is private;
- is devoted to one activity;
- contains chairs and tables;
- has display systems such as blackboard, whiteboard;
- uses technology;
- is occupied by one teacher and several students;
- is used by a particular homogenous class;
- is suited to lecturing.

Consider the assumption that a classroom occupies a discrete space:

*Opposite* Not in one place, distributed as in a social network, non-existent
*Distortion* A classroom in motion, changing shape

Many educational innovations such as distance learning, blended learning, OpenCourseWare (OCW), discovery learning, teacher as facilitator, multiple intelligences, autonomy in learning, negotiated learning and workplace learning can be construed as challenges to orthodox educational assumptions.

## Conceptualization

The way an issue is conceptualized creates a context for thinking and will suggest ingredients that need to be addressed. One of the differences between subject or disciplinary areas is in the way they conceptualize ideas. The resulting symbolic representation influences the manipulation possible.

Einstein's approach to the photoelectric effect, considering light as particles instead of waves is a classic example of reconceptualization leading to creativity. An everyday classroom example is the conceptualization of a problem in numerical, algebraic or graphical form, each of which opens up different mental processes and creative possibilities. Cross-disciplinary activities can be particularly effective because different disciplinary areas force learners to conceptualize in different ways and so provoke creativity.

### Diagrams

Diagrams offer a means of visualizing a situation that can assist creativity by literally 'presenting the bigger picture' in a way that reveals structure and relationships. In order to stimulate more creative forms of conceptualization, a teacher can encourage learners

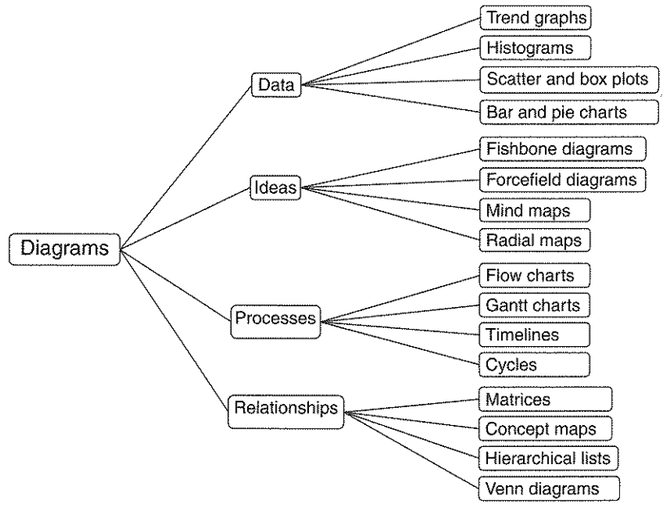


**Figure 16.2** Radial map of diagrammatic representations

to use a range of symbolic representations – particularly ones that would be atypical for that particular idea. For example, an English teacher could require a class to come up with a graphical representation of a literary idea.

*Example*

Figure 16.2 presents a radial map of diagrammatic techniques that can be used to analyse, manipulate or present data, ideas, processes and relationships.

**Table 16.2** Random metaphors that could be applied to teaching and learning

| | | |
|---|---|---|
| Committing a murder | Colonizing a territory | Camping in a wilderness |
| Building a house | Sky-diving | Prospecting for gold |
| Sailing a ship | Playing politics | Surfing the web |
| Cooking a fancy meal | Running a marathon | Starting a revolution |
| Going fishing | Training an animal | Renting a DVD |
| Going on a date | Putting out a fire | Fighting a disease |
| Taking a photograph | Dress-making | Doing stand-up comedy |
| Going to a church service | Going on a diet | Performing a magic trick |
| Spreading propaganda | Negotiating a contract | Planting a garden |
| Having a baby | Getting a divorce | Flower-arranging |
| Pruning a tree | Conducting an orchestra | Producing a TV programme |



## Metaphors

An interesting way of conceptualizing a problem is in the form of a metaphor which is a way of thinking about one thing in terms of another. Teachers are generally well-used to using metaphors in their efforts to simplify and explain complex ideas in understandable ways. While it is reasonable to select a metaphor intentionally for teaching purposes, a randomly generated metaphor may be more likely to create novel links and parallels when seeking creative outcomes.

*Example 1: random metaphor*

Table 16.2 presents a selection of metaphors which could be selected at random and applied to any situation. For example, the first metaphor, 'committing a murder' applied to learning could suggest a forensic approach to assessment in which a student needs to amass evidence in order to make a convincing case that the 'crime' of learning has occurred.

*Example 2: synectics*

Instead of a random metaphor, synectics uses selected metaphors. In this technique, developed in the 1960s by the inventor-psychologist William Gordon, a facilitator helps a client to tackle a problem in a creative way by suggesting analogies that may be direct, personal, symbolic or fantastic:

| | |
|---|---|
| *Direct analogy* | Compares similar situations in technology or biology |
| *Personal analogy* | Imagines the person as the problem |
| *Symbolic analogy* | Symbolizes the problem with some image |
| *Fantasy analogy* | Identifies outrageous perfect solution |

(based on Puccio and Cabra 2010: 162)

## Generation of ideas

One way to have a good idea is to have many ideas. However, people are often focused on arriving at a single solution as quickly as possible and are uncomfortable with uncertainty, ambiguity or delay. Ideas, once produced, are often rejected too quickly and dismissed because they are impractical or even ridiculous at first glance. Tools have been created that increase the number of ideas generated by postponing evaluation so that alternatives are explored, and ideas have time to develop.

**Table 16.3** Brainstorming technique

| | |
|---|---|
| **1. Preparation** | The class or group get together and are put at ease with relaxation exercises and bonding activities |
| **2. Process** | The leader writes out the subject for brainstorming and explains the rules: |
| | *Ideas generation* — Ideas are called out |
| | *Suspension of judgement* — No commenting on merits of ideas |
| | *Piggybacking* — Ideas may build on previous ideas |
| | *Quantity not quality* — Number of ideas is most important |
| | *Recording* — Scribe writes out ideas on flipchart |
| **3. Evaluation** | The written ideas are evaluated using one of the methods described later |

### Brainstorming

The classic example of idea creation is that of brainstorming, as described in Table 16.3. This is a group process with individuality subsumed. Everyone becomes involved in suggesting ideas and building on the ideas of others. There is no criticism allowed at the early stage and way-out ideas are welcomed. It is important that an atmosphere is created that permits free associations and sharing of ideas without fear of ridicule or rejection.

*Example*

Brainstorming could be used in a classroom situation as a way of identifying learners' preconceptions and knowledge of a topic before it is studied, or as a means of considering alternative creative approaches to a problem.

Criticisms of brainstorming are that it has not been found to be as productive as multiple ideas gathered from individuals, and that individuals' contributions are vulnerable to group influences and relationships. Findings show that individual idea generation may be superior to the team generation of ideas (Diehl and Stroebe 1987). Web-based brainstorming where individuals contribute initial ideas remotely can be more productive than the face-to-face variety.

### Lateral thinking

The 'lateral' thinking described by de Bono (1970) refers to the idea of thinking 'sideways' to multiple alternatives rather than following one idea more intensely. The metaphor is of digging for treasure in a field. It is better to dig many shallow holes rather than a single hole deeper and deeper.



*Example*

In communicating with parents, an infant teacher was faced with the problem of her charges losing notes or forgetting to give them to their parents. She thought laterally and realized that their lunchboxes could also serve as post boxes. She placed the notes to parents in the lunch boxes which were guaranteed to be opened at home for refilling.

## Exploration of ideas

Ideas once generated are in danger of being dismissed too soon to permit creativity to emerge, so there are tools that postpone judgement and maintain the ideas to allow further exploration.

### Random word association

No matter how different two things may be, it is always possible to come up with some way of connecting them. Random words can be used to stimulate creative thinking by demanding relevance to a topic under consideration. Table 16.4 illustrates how the process works.

**Table 16.4** Random word association

| | |
|---|---|
| **1. Random word** | Learners pick a word at random from a book or list |
| **2. Ideas generation** | They list all the ideas that the word brings to mind |
| **3. Application** | They then see how the ideas can be applied to the issue |

*Example*

Suppose the issue under consideration is classroom design.

| | |
|---|---|
| *Random noun* | Buttercup |
| *Ideas generation* | Growth, roots, colour, seasonal, temporary, organic, clusters, weeds, wild, fertilization, decay, regrowth |
| *Application* | Classrooms could vary with the seasons and could be temporary; could grow and decay and pop up in suitably fertile locations; could be clustered spaces where ideas are also clustered |

### Morphological forced connections

Table 16.5 illustrates the method of morphological forced connections described by Adams (2001: 135–7). It is based on the idea of a series of columns headed by the

**Table 16.5** Morphological forced connections

| | |
|---|---|
| **Analysis** | Learners analyse and describe a process, problem or object into components, elements or attributes |
| **Tabulation** | They then make a table with an element as a heading of each column |
| **Variation** | Under each heading they write alternatives or variations of that element |
| **Combination** | They randomly combine one item from each column to generate an alternative scenario |
| **Evaluation** | They evaluate the scenarios generated |

components of a situation under which are listed alternatives – morphologies – for each. Forced connections are then made by randomly selecting one item from each column.

*Example*

Consider four typical elements of an educational institution – environment, teacher, pedagogy and assessment. Figure 16.3 lists variations of each element. Each column has 12 alternatives, so combining one item randomly from each column could produce 12 × 12 × 12 × 12: 20,736 scenarios to be explored. One combination illustrated in Figure 16.3 selects workplace, no teacher, problem-based learning (pedagogy) and assessment by presentation. This could mean a team in a factory, working as a group without any facilitator, investigating a problem at work and making a presentation of their findings.

A more exotic example might select the elements: cage, coach, peer learning and external assessment. This could be the Roman amphitheatre of the classical world with gladiators in a cage fighting and learning from each other, subject to the external judgement of the audience and emperor, signified by thumbs 'up' or 'down'.

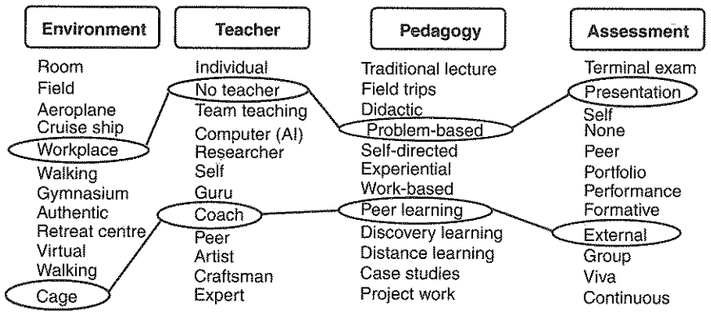


**Figure 16.3** Example of morphological forced connections



## Evaluation of ideas

After the divergent, value-neutral, generative phase comes a convergent one where evaluation takes place: 'No one has ever called a new idea which he or she did not like, "creative"' (de Bono 1982: 60). Two tools attributable to Edward de Bono are 'thinking hats' (1985) and PMI ('plus, minus, interesting') (1993).

### Six thinking hats

This tool is an attention-focusing device that concentrates on one aspect of evaluation at a time. The teacher can guide learners in a systematic process, using a number of different perspectives represented by the imaginary wearing of particular 'hats', as described in Table 16.6.

**Table 16.6** Six thinking hats

| Hat | Focus | Style of thinking |
|---|---|---|
| White hat | Information | Learners consider only factual information including missing information |
| Red hat | Feelings | Feelings are taken into account – including mixed ones |
| Green hat | Creativity | The creative potential of ideas is considered, leading to practical proposals |
| Yellow hat | Benefits | Learners express only the good aspects of an idea and logically justify the benefits |
| Black hat | Weaknesses | Negative aspects are considered and critically evaluated |
| Blue hat | Overview | Overall view of focus on process and purposes |

*Source:* based on de Bono (1985)

*Example*

In a typical classroom situation, a sequence for evaluating creative ideas might be:

| | |
|---|---|
| *Red hat* | To air initial feelings |
| *White hat* | To consider information about the issue |
| *Green hat* | To generate ideas |
| *Yellow hat* | To see the strengths of these ideas |
| *Black hat* | To see the weaknesses |
| *Blue hat* | To see how the hats need to be used again if necessary |
| *Black hat* | To assess the ideas and select the best |
| *Red hat* | To see how people now feel about it |

The teacher needs to be vigilant in maintaining appropriate contributions depending on the hat, as pupils will have a natural tendency to drift into other hats as they speak.

### Plus, minus, interesting

PMI is illustrated in Table 16.7, and is a useful, simple and straightforward evaluation method that de Bono describes as a 'scanning tool' that directs attention to the positive, negative and interesting aspects of an idea (de Bono 1993: 128–9).

**Table 16.7** PMI – plus, minus, interesting

| | |
|---|---|
| **Plus** | Learners list all the positive aspects and benefits of an idea while ignoring any drawbacks |
| **Minus** | Learners list all the negative aspects and drawbacks of an idea while ignoring the benefits |
| **Interesting** | Learners list observations that are neither good nor bad but are of interest |

*Source:* based on de Bono (1993: 128–9)

#### *Example*

For young learners PMI can be effective in directing them to make clear judgements about the good, the bad and the interesting. More sophisticated users such as undergraduate or postgraduate students in a university setting, and engaged in critiquing academic articles, could begin with a PMI approach – perhaps making a table of these aspects. This could then be followed by a more discursive integrative account where the evaluation is synthesized and a final judgement made.

## Conclusion

We have considered a selection of the most well-known and popular tools and have attempted to show how they could be used in an educational setting. The tools clarify and articulate thinking methods that have often been tacit and acquired contingently. Different tools can be used for different purposes depending on the topic, the discipline, the educational level and the sophistication of students.

There are two cautionary notes that need to be borne in mind however. 'Stand-alone' thinking skills programmes which concentrate on generic thinking tools are of little use without disciplinary knowledge. Also, learners need to be helped to overcome ingrained conservative attitudes and convergent thinking habits. However, it is our experience that, with proper preparation, learners enjoy using these creative thinking tools as they are fun, simple to apply and useful.



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