

Teaching and Thinking

A literature review of the teaching of thinking skills



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Teaching and Thinking –

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Few people think no more than two or three times a year; I have made an international reputation for myself by thinking once a week. George Bernard Shaw

Introduction

In today's society emphasis is on data transfer and employers look for employees who are critical, creative, and flexible. Employees who can use the abundant data in generating new ideas are favoured above those who lack the ability to absorb information to create new ideas to solve problems. The age of information marks a new stage in our attempt to acquire the new ideas and skills required for development.

Accordingly, a frequently asked question in education, nowadays is- What are the characteristics of future learners who have to cope with the requirements of the information age? Of course, this is not an easy question, but there is a general consensus that in order to turn out productive citizens, we have to equip them with the right thinking tools. That explains the increasing interest in learning and teaching thinking skills. It is not surprising therefore, that there is growing attention to developing the learning and intellectual potential of all members of a society (students, employees and citizens). Many books about thinking have been published. Global conferences are held to discuss new findings in this field. Many thinking programmes have been designed to teach the different kinds of thinking. In short, thinking has become a major agenda in education and business across the world. No wonder that many schools include 'Teaching thinking skills' as one of the ingredients of their vision and mission. This interest in teaching thinking is clear in the UAE, especially in the emirate of Abu Dhabi where improving children's thinking lies at the heart of education in its schools.

Can thinking skills be taught? What are the main theories on teaching thinking? What approaches have teachers taken? How does teaching thinking affect students and teachers? What could teachers do? These are the main questions that this discussion paper seeks to answer.

1. Can thinking skills be taught?

In this section, I consider some basic issues to answer the main question of this paper: Can thinking skills be taught? I raise a number of questions in an attempt to answer the main question.

1.1 Background

Invest a few moments in thinking. It will pay good interest. Author Unknown

As Nisbet (cited in Coles & Robinson 1991, p. 27) states the concept of teaching thinking is not new. The same idea is stressed by Swartz & Perkins (1990, p.5) 'it is important to remember that concern with developing students' thinking, far from being a fad, is one of the most persistent and ambitious aspirations of education, with a tradition stretching back at least to Plato'. Plato was famous for teaching thinking through the Socratic dialogue and traditional logic. In the 19th century, Latin and Mathematics were taught to strengthen the faculty of reason. Formal logic was added to school curricula in many countries to provide students with training in rational thinking. The theory of constructivism has the most noticeable effects on teaching practices by viewing learners as active creators of their own knowledge. By the end of the twentieth century, many programmes for teaching thinking invaded educational and business organisations in response to the development in educational and cognitive psychology and the growth of information technology.

Some commercial programmes focus on placing thinking at the heart of school curriculum. However, can we teach thinking? Can we teach student to be good thinkers? And if so, how? Before reviewing the two main approaches of teaching thinking, it is necessary to understand the meaning of thinking, the reasons for teaching thinking in schools, and theories on thinking.

1.2 What is thinking?

You and I are not what we eat; we are what we think. Walter Anderson (1998)

Different people suggest various definitions of thinking and thinking skills. They focus on mental activity, logic and reason and the critical use of information.

Every one can have his own meaning of thinking. A grade six student in my class thinks that thinking is solving problems. Beyer (1991, p. ix) considers thinking to be 'the mental manipulation of sensory input and recalled perceptions (information and thoughts stored in memory) to make or find meaning- to reason about or with, to formulate thoughts, and to judge.' De Bono (1991, p. 33) gives a broad meaning of thinking which can include most of the other definitions by stating that 'Thinking is the deliberate exploration of experience for a purpose. That purpose may be understanding, decision making, planning, problem solving, judgement, action and so on.' De Bono considers that knowledge, intelligence and thinking are the ABCs of education. Swartz and Perkins (1991) describe good thinking in this way:

To us, good thinking is, at its roots, something with which we are all familiar. We accomplish it at times when we make careful choices and solve problems effectively. It involves the use of keen critical skills and opens creative exploration in which we call up and gather relevant information that we bring to bear on the issues with which we are grappling. (Swartz & Perkins 1991, p. xvii)

3.3 What are thinking skills?

Thinking is like loving and dying. Each of us must do it for himself.
Josiah Royce (cited in Guillemets 2006)

According to Beyer (1991, p. xi) 'Thinking skills are the discrete, precisely delineated mental operations used in varying combinations as we think.' De Bono (1991) describes these skills as tools of effective thinking. Swartz and Perkins (1991) talk about 'subskills' to avoid any misunderstanding of the main five kinds of thinking. They say that a 'thinking skill is a competency that contributes to some kind of thinking' (Perkins, p.19). Each type of thinking includes a number of thinking skills or subskills (or for short, skills). Kagan (2003) divides thinking skills into three types: understanding information, manipulating information, and generating information. In each of the three categories are specific skills. For example, "summarize" is related to understanding information; problem solving is related to manipulating information; and questioning is related to generating information. In contrast to the above list of skills Lipman (1983) thinks that 'Thinking skills is a catch-all phrase' (cited in Coles & Robinson 1991,p.9) because the list of skills has no end due to the abundant nature of the intellectual powers of mankind.

From what has been said it is clear that thinking has many skills. The word 'skill' means that it is something that can be taught, learnt and practiced in the course of teaching and learning. This implies that thinking has to be viewed as a 'process, not a place'. Thinking skills are not content to be placed into the brain. Rather, they are processes which, when practiced, empower the brain to work more efficiently' (Kagan 2003). This nature of thinking skills raises a question: Why do we need to learn and practise these skills?

1.4 The need for teaching thinking

No one doubts, theoretically, the importance of fostering in school good habits of thinking. But apart from the fact that the acknowledgement is not so great in practice as in theory, there is not adequate theoretical recognition that all which the school can or need do for students, so far as their minds are concerned... is to develop their ability to think. John Dewey (cited in Coles & Robinson 1991, p.9)

Different writers give various aims of teaching thinking. Here, the most-noteworthy ones are highlighted. According to Fisher (2003), humans need to be educated which means that all people have the right to learn. He states that 'the key function of education is to teach children to think critically, creatively and effectively' (Fisher 2003, p 6).

Another reason for teaching thinking skills is that students love it. 'We enjoy thinking classes more than any other classes,' say many students in my school. They enjoy solving problems and puzzles. Many students prefer to find the answer rather than be given it without 'thinking time'. I think that students favour teachers who focus on higher order questions because they motivate them to be engaged in the discussion. Fisher (2003, p.7) echoes this when he says that students 'like those teachers who make them think. They prefer lessons in which they are for example asked to interpret, analyse, or manipulate information, or apply acquired knowledge and skills to novel problems or new situations.'

Thinking is not only a source of enjoyment, but also enhances academic achievements. Fisher (2003, p.8) claims that 'teaching thinking and reasoning is

central to raising standards even in the most basic skills of the curriculum'. Some people add the 4th R (reasoning) to the three 'Rs' (reading, writing & 'rithmetic). The reports of the 'back-to-basics' movement in the US emphasise the need for attention to intellectual development' (Swartz & Perkins, p. 6). Teaching thinking skills enables students to utilize new information in new situations. Hamers & Overtoom (1997) assert that 'It is precisely the capacity to think which enables students to acquire new knowledge and replace old knowledge by new, and it teaches them to recognise the value of gaining knowledge' (Hamers & Overtoom, 1997, p.23).

In a changing world, it is difficult to assess what knowledge our students will need in the future. Therefore, it is logical to provide them with the skills necessary to deal with flow of information. Kagan (2003) makes this view clear: 'In the face of the accelerating information explosion, having the student memorize one more fact is of little value compared to having the students learn how to categorize, analyze, synthesize, summarize, and apply information'.

Psychologists also promote the interest in developing students' thinking. The works of Bruner, Sternberg, Vygotsky, Gardner, etc. have contributed to the increasing concern with the development of intellectual potential of students. 'Their achievements and others put us in a better position today to plan intelligent approaches to developing students' intellect than was the case during the last swing of the pendulum' (Swartz & Perkins 1991, p.7). For example, Sternberg (1987) lists four aims of teaching thinking at the general level

1. to make students better all-round thinkers, and also better thinkers in certain disciplines;
2. to help students learn to make the most of their best abilities;
3. to help to lessen their weakness in thinking skills;
4. to teach them to realise their potential (cited in Hamers & Overtoom 1997, p.24).

1.5 Thinking in Islam

'Now let man but think from what he is created!' (Qur'an)

Muslims are encouraged to practice critical and creative thinking. There are 642 verses in the Qur'an encouraging and asking Muslims to use different thinking skills like reasoning, deducting, evaluating, etc. The Qur'an enjoins humans to

study the world around them. The verses of the Qur'an call upon them to think, to investigate and to use their minds.

Dr. Bakkar, an Islamic thinker, suggests that in our attempt to overcome problems, there is 'a great need for thinking because there are *Sunan* or divine principles, which govern human life, which only through thinking could be explored and discovered' (cited in Badi & Tajdin 2005, p.8). Moreover, Badi and Tajdin (2005, p.7) state that 'thinking is considered as *'Ibadah'* or a form of worshipping Allah, which is rewarded, provided it is done with sincerity *'Ikhlas'* and good intention and for a good purpose'.

1.6 Thinking and Politics

What luck for rulers that men do not think? Adolph Hitler (cited in Moncur 2004).

Another set of reasons for teaching thinking skills centres around the social nature of human life, and in particular the link between democracy and citizenship. De Bono (1976, p.21) thinks that politicians do not like the idea of teaching people thinking skills. He thinks that 'thinking is a political decision, since some political systems would prefer people to follow rather than think'. Thinking is a device that makes us see things better and in this way, we avoid misunderstanding and hasty judgments that lead by feelings.

To be able to practise critical reflection skilfully and positively necessitates the need for teaching them the principles of critical thinking practically to respond to positive criticism and rational thinking. In democratic societies like in the West, it is a must to teach people how to be good thinkers. Fisher (2003) states that 'There can be no democratic liberty if citizens lack the skills to differentiate lies from truth. ... we need the skills of critical thinking to help us to form intelligent judgments on public issues and thus contribute democratically to the solution of social problems' (Fisher, 2003 pp. 10-11).

In spite of the many reasons given in literature showing the importance of teaching thinking skills, still many politicians, educators, businessmen, parents, etc. are hesitant to start or do not know how. By corollary, independent thinking is necessary and inevitable. It has to happen and will happen.

2. What are the main theories on thinking?

A man paints with his brains and not with his hands. Michelangelo

There are various theories and views describing how thinking develops. It is impossible to present all of these views within the constraints of this short paper. The best-known views that have been put forward by Piaget, Bruner, and Vygotsky, the information processing theory (ITP), constructivism and Howard Gardner's work on multiple intelligences are highlighted.

2.1 Jean Piaget

Piaget's theory of cognitive development explains the development of thinking in children. According to Piaget 'the development of thinking in children progresses according to successive, discrete stadia' (cited in Hamers, Luit & Csapo 1999, p.14).

Children think and reason differently at four periods in their lives. Piaget thinks that everyone passes through these distinct stages in order. Each stage has specific cognitive functions which are accomplished. Hester (1994, pp.58-60) gives a brief summary of the four stages: 'the sensory-motor period (birth to two years), the pre-operational period (two to seven years), the stage of concrete-operations (seven to twelve years), and the formal operation (beginning at age eleven).

Piaget & Inhelder (1969) consider the most critical factor in a child's cognitive development to be interaction with peers and environment. Such interaction results in arguing or debating with peers. In addition, Piaget sees the child as an active processor of new impressions and experience which lead to thinking.

Piaget states that 'The child can only learn that which fits in with its current thinking stage' (Hamers & Overtoon 1997, p.15). However, his theory and studies highlight a number of significant elements in teaching children how to think. Fisher (2001, p. 8) mentions three needs:

- to look at the reasons why the child is thinking in such a way

- to remember that thinking is doing and not just being told, that is an active not a passive process
- for children to explore certain key concepts which help unlock their potential.

2.2 Jerome Bruner

Bruner's work on childhood learning has made him a key figure in educational reform in the US and Britain. Bruner 'ascribes an important role to language in the development of thinking: thinking leads to language, but, thereafter, language is responsible for the improved development of thinking' (Hamers & Overtoon 1997, p.15).

Bruner considers learning as an active, social process in which students construct new ideas or concepts based on their current knowledge (cited in Flores 2001). He thinks that the child experiences three stages of continual process of processing and representing information. Bruner (cited in Hevern 2004) differentiates between three phases or stages in which learning occurs: enactive, iconic and symbolic. Bruner (cited in Flores 2001) asserts that education should help students to experience cognitive and intellectual mastery. This is very useful to students because 'they are able to access information that they were previously unable to utilize. This reward and excitement perpetuate the student to learn even more.'

One important difference between Piaget and Bruner is that the latter believes that we can learn anything at any age. Bruner states 'No matter the age, or stage of development as Piaget believed, there is an appropriate version that corresponds to that age-even if it is preparatory' (cited in Flores 2001). Bruner emphasises the strategy being used in teaching rather than by the environment alone. According to Bruner (1977) the intellectual development of the child is 'no clockwork sequence of events; it also responds to influences from the environment, notably the school environment. ... It [instruction] can also lead intellectual development by providing challenging but usable opportunities for the child to forge ahead in his development' (Bruner 1977, p.39).

2.3 Lev Vygotsky

The Soviet psychologist Lev Semenovich Vygotsky (1886-1934) emphasises that 'cognitive functioning occurs first on the social level, between people, and that

the child then internalizes this in individual development' (cited in Rogoff & Wertcsch 1984, p.1).

A central concept in his theory is the Zone of Proximal Development' (ZPD). Vygotsky (1978) defines ZPD as 'the distance between the actual developmental level as determined by independent problem solving and the level of potential development through problem solving under adult guidance or in collaboration with more capable peers' (Vygotsky 1978, p. 86). He believes that what children can do with our help today they will be able to do by themselves in the future. It is in the proximal zone that teaching may be defined. In Vygotskian terms, teaching is good only when it 'awakens and rouses to life those functions which are in a stage of maturing, which lie in the zone of proximal development' (cited in Rogoff & Wertcsch 1984, p.3).

To Vygotsky (1978) testing does not show us the mental age of children. Tests show what children can do by themselves, but they ignore what they can do with the assistance of others. He gives an example of two children who are ten years old chronologically and eight years old in terms of mental development. If we help children by giving them clues or explanations, they do better. When we ask a seven-year old child to solve a problem, and he does, we usually say that his mental age is seven. Suppose that we gave the same problem to a four-year child, he wouldn't answer it. But if we offer the child with leading questions, the child will solve the problem. In this case the two children are mentally at the same age although their actual development age is different. The concept of ZPD explains this difference between four and seven. The two children in the given example revealed the same mental age from the viewpoint of developmental cycles already completed, but the developmental dynamics of the two were entirely different.

Vygotsky emphasises the importance of social interaction in developing the intellectual development of children. He states that 'learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent developmental achievement' (Vygotsky 1978, p. 90).

2.4 The Information Processing Theory (IPT)

George Miller describes the processes that take place between the input and output of information processing. Orey (2001) points out that the 'Information Processing (IP) is a cognitive processing theory... which seeks to explain how the mind functions.' The IPT gives more weight to the mechanism of information processing rather than to how we learn.

According to Miller (cited in Hassan 2005) 'the short-term memory could only hold 5-9 chunks of information (seven plus or minus two) where a chunk is any meaningful unit. A chunk could refer to digits, words, chess positions, or people's faces.'

In explaining a second concept, Miller uses the computer as a model for human learning. The human mind takes in information 'input', processes it, stores and locates it and generates responses to it 'output'. Hassan (2005) clarifies this concept by saying that 'processing involves gathering and representing information, or encoding; holding information or retention; and getting at the information when needed, or retrieval.' Duijker (1999) described the concept of thinking as follows:

Thinking denotes for psychology a coherent complex of specific theoretical problems, dealing with the complexity of the information processing activities (what do they consist of and how are they controlled?) and with the roles these representations of information play) how are they established, what is their nature and structure? (Duijker cited in Hamers, Luit & Csapo 1999, pp.15-16).

Sternberg (1999, p. 489) also identifies three different components involved in processing information. They are (a) *metacomponent* [control]: executive processes (i.e., metacognition) (b) *performance components* [output]: and (c) *knowledge-acquisition components* [input].

For better encoding of information the material has to be meaningful and that activation of prior knowledge is a must. Better encoding of information will enable students to store this information in the long term memory (LTM) in a way that makes it easy to retrieve it when needed. In my opinion, students who do not have the opportunity to practice thinking skills which ensure their active

engagement with the taught material will fail to make good connections between the thousands of information chunks they store in their LTM.

An important term borrowed from IPT is 'metacognition': thinking about one's own thinking which works as executive processors. In teaching thinking it is very important to provide the students with metacognitive strategies or skills like planning for learning, thinking about thinking, evaluating learning, graphic organizers, mind mapping, etc. I will refer to 'metacognition' when discussing the ideas of Swartz.

Information Processing Theory (2003) highlights the importance of metacognition. 'When you put effort into processing information, you will become capable of a metacognitive or executive level of thinking that includes self-awareness, self-inquiry (self-dialogue), self-monitoring and self-regulation of the processes and contents of thoughts, knowledge structures and memories'. Hamers and Overtoon (1997, p. 19) also believe that metacognition is necessary for developing higher thinking skills. They point out that students need to think about their thinking 'before, during and after a task by, respectively, activating acquired knowledge, monitoring [their] own activity and assessing performance and consequences'.

Kagan (2003) similarly believes that 'There is consensus that information processing is the essence of thinking skills.' The question becomes, How best to develop them? He suggests an instructional approach which 'treats thinking skills as a process and demands we teach existing content and lessons using instructional strategies that foster thinking'. Kagan (2003) talks about a number of structures for teaching thinking like: 4-S Brainstorming, Round Robin, Round Table and Pairs Compare.

2.5 Constructivism

Constructivism is another important theory that has influenced teaching and learning approaches and thinking to a great extent. It tells us how we learn. According to Martin Briner (1999) 'learning is based on students' active participation in problem-solving and critical thinking regarding a learning activity which they find relevant and engaging'.

In a constructivist classroom, the teacher acts as a facilitator. He/she 'guides the student, stimulating and provoking the student's critical thinking, analysis and synthesis throughout the learning process' (Briner 1999). For a student to practice thinking, he/she needs to be an active creator of his/her own knowledge through asking questions, exploring, assessing what he/she knows and applying metacognitive strategies, etc. In a constructivist classroom, the environment encourages critical and creative thinking.

Murphy (1997) describes a number of different characteristics of constructivism as perceived by some researchers and theorists. Jonassen (1991) identifies eight principles of constructivism, for example

- Create real-world environments that employ the context in which learning is relevant;
- The instructor is a coach and analyzer of the strategies used to solve these problems;
- Evaluation should serve as a self-analysis tool;
- Learning should be internally controlled and mediated by the learner (pp.11-12). (cited in Murphy 1997)

2.6 Thinking and Intelligence

'An intelligence test sometimes shows a man how smart he would have been not to have taken it'. Laurence J. Peter (cited in Moncur 2004)

Part of our knowledge of thinking is derived from the works of psychologists. Psychometry is an important theory that has its impact on the teaching of teaching. Hamers and Csapo (1999) think that the psychometric studies have influenced the research of thinking in at least two important ways: '(a) by making psychological traits measurable... and (b) by launching the concept of intelligence' (cited in Hamers, Luit & Csapo 1999, p.16).

Alfred Binet (1875-1911) was the first to develop an intelligence test in France, later to be known as IQ tests. Binet believes that we can improve children's thinking in spite of not having got the innate ability contrary to what many psychologists thought of intelligence as something that we cannot improve because it is largely inherited. He (cited in Fisher 2001, p.6) 'was critical of the claim that a person's intelligence is a fixed quantity and cannot be improved. We ought to protest against this brutal pessimism, he said, and he tried to show that it had no foundations.' For Binet, the mental faculties that we are born with are

not important, but how we use and develop them is more important. He thinks 'What children need to do is to learn how to learn'(Fisher 2001, p.6).

Binet used IQ tests to help children to learn by providing them with appropriate teaching. A low or high IQ score does not tell us a real picture about the thinking abilities of two different persons. So, IQ tests are rejected for many reasons.

Fisher (2001, pp.6-7) thinks that

Two individuals may receive the same IQ score, one being at a peak of thinking power, the other capable of a huge spurt of intellectual attainment. ... The IQ test does not recognise potential, it does not assess a child's learning experiences, it cannot judge key qualities like imagination, creativity or perseverance.

De Bono (1991) clarifies the relationship between thinking and intelligence. He says that 'Thinking is the operating skill through which intelligence acts upon experience.' In other words thinking guides and directs intelligence to reach its goals. Since the relationship is so strong, we need to have a good knowledge of the multiple intelligence (MI) theory which developed by Gardner.

2.7 Multiple Intelligences (MI)

Howard Gardner set forth the theory of MI as a response to the prevailing understanding of intelligence as something unitary, fixed and that can be measured by IQ tests. Gardener defines intelligence as '... ability to solve problems of fashion products that are of consequence in a particular cultural setting or community' (cited in Kagan 1998, p.2.1).

According to Gardner 'humans possess many ways of knowing and expressing their world' (cited in Weber 2005, p.4). These ways are described as the eight multiple intelligences. Laurie Kagan (cited in Kagan1998, p. 4.2) pairs the eight intelligences to make it easy to remember them: Traditional intelligences (Verbal/linguistic & Logical /Mathematical), Art and Music Intelligences (Visual/Spatial & Musical/Rhythmic), Outdoor Intelligences (Bodily/Kinesthetic & Naturalist), and Personal intelligences (Interpersonal & Intrapersonal).

Gardner's definition of intelligence implies a number of functions. Kagan (1998, p. 3.10) lists eight functions: survival, skills, perceptiveness, problem solving, communication, creativity, knowledge, and wisdom. Understanding these

functions enables teachers to create suitable learning environments and experiences.

2.8 The question redefined

In the light of this background, can thinking skills be taught? This question is far too general to be answered fully in a discussion paper like this but in the following section; the ways in which teachers have attempted to improve student's thinking are identified.

3. What approaches have teachers taken?

There is a general agreement among writers on 'two approaches (Maclure & Davies, 1991): (a) the general approach with separate courses for teaching thinking; and (b) the specific approach with integrated courses, which means that the thinking skills are embedded in the school subjects' (cited in Hamers, Csapo & Luit 1999, p.22).

Parks, Fischer and Swartz (1998, p.8) classify the approaches to teaching thinking into three categories. They divide the second approach into two types. They differentiate between teaching thinking using the school subjects implicitly and explicitly.

3.1 Specifically Designed Programmes

'In 1990 Nisbet and Davies identified over 30 programmes of instruction on thinking skills but went on to suggest that there were in fact over a hundred in the USA alone' (cited in Wilson 2000). I will talk in detail about one of these programmes: Cognitive Research Trust 'CoRT' which is designed by Edward De Bono in the seventies and developed through the Cognitive Research Trust.

3.2 Cognitive Research Trust (CoRT) – Edward De Bono

Edward De Bono is considered as the leading authority in the direct teaching of thinking as a skill. His programme, CoRT, is considered the largest programme anywhere in the world for the direct teaching of thinking as a skill. The CoRT programme has six sections, each of which consists of ten lessons. Each section covers one aspect of De Bono's definition of thinking: breadth, organisation, interaction, creativity, information and feeling, and action. Its overall aim is to translate thinking which, he claims, is 'a pretty nebulous subject and needs anchoring with some focus of attention' (De Bono, 1991, p.187) by use of structured exercises.

The popularity of this approach stems from its simplicity and practicality. I have started learning and teaching De Bono's ideas (CoRT, Six hats and lateral thinking) since 2000. The ideas and concepts are crystal clear to learn and

teach. All people, no matter their ages, classes, location, race can be trained to practice his programme. There are no requirements for mastering the various thinking skills apart from being interested in learning thinking skills and a strong belief that these skills are learnable and teachable and useful in our life.

The essence of the CoRT thinking method is to direct attention on purpose to different aspects of thinking and to crystallize these aspects into definite concepts and tools that can be used deliberately or even artificially. De Bono (1986, p.68) believes that

The ultimate aim of the thinking lessons is very similar to that of coaching in sports: to make the basic operations of thinking second nature so that they are carried out automatically, smoothly, and without fuss or effort. This requires defining the operations and practicing them deliberately, and that is exactly what the CoRT Thinking Lessons are about.

CoRT thinking lessons use tools to teach thinking. For instance, in order to find 'plus', minus' and 'interesting' points about an idea, De Bono suggests the tool 'PMI'. What happens when a teacher says to his students: 'I want you to apply PMI in discussing an idea?' The attention of the students is directed towards the plus, minus and interesting points. In another situation when a teacher writes on the board a sentence likes this: *All schools should open for three days a week.* *Discuss.* It is possible that many students agree with the statement and they will focus on the advantages (pluses). They will not talk too much about the disadvantages and some may ignore the 'minuses' in their discussion. But if teachers direct their attention by using 'PMI', the situation is completely different. These artificial tools are not only tangible, but also transferable and renewable.

3.3 The Six Thinking Hats Concept

Think left and think right and think low and think high. Oh, the thinks you can think up if only you try! Dr Seuss (cited in Dyck 2004)

The six thinking hats concept is a popular method designed by De Bono for teaching thinking. It is a very practical technique that can be used to teach thinking skills in a meaningful way. De Bono (2000, p.11) wants us to overcome the main difficulty of thinking.

Confusion is the biggest enemy of good thinking. We try to do too many things at the same time. We look for information. We are affected by feelings. We seek new ideas and options. We have to be cautious. We want to find benefits. Those are a lot of things that need doing. Juggling with six balls at the same time is rather difficult. Tossing up one ball at a time is much easier.

The six hats are directions for thinking. Instead of trying to do everything at once, we learn to handle the different types of thinking one at a time. Students learn that different thinking is needed in different learning situations. Students focus their discussion deliberately on one direction like information.

The six thinking hats are grounded in De Bono's famous concept 'Lateral Thinking' which invites us to base our judgement on a comprehensive study of the different aspects of any issue separately. In the end, these different aspects come together to give full-colour thinking.

In the six hats method, thinking is represented by a different colour hat to help students visualize six different kinds of thinking and to convey something of the meaning of that thinking, for example, green as grass, white as neutral and objective and blue as the colour of the sky. A summary of the Six Thinking Hats is given in figure 4.1.



Figure 4.1: A summary of the Six Thinking Hats

It is my experience that whenever I ask my students to think about anything we study, they are often at a loss. But, when I use the hats, they usually think more richly and at length. The six hats expand their perceptual powers. For example, compare the responses given to the following task.

Read the story (any story) and tell what you think about it.

Possible answers:

- I do not like that story.
- I liked reading the story.
- The main character is foolish.

Six Hats answers:

White hat (facts)

- The story took place in Canada.

Yellow hat (benefits, positive things)

- The story teaches us many lessons

Black hat (weaknesses/ problems)

- I do not understand how a father kills his sons.
- I do not think it is true to punish people by killing them because you harm their families.

Green hat (creativity / new ideas)

- The writer could suggest different ways of punishment.
- The writer could suggest another end.

Red hat (emotions/feelings)

-I enjoyed reading the story.

-It's wonderful!

3.4 Infusion Approaches

The infusion approach will be described and analysed as exemplified in the work of Robert Swartz and his colleagues. ACTS (Activating Children Thinking Skills) is an illustrative example adopting this approach.

In infusion approaches, the development of thinking is infused in and through the existing curriculum. Hence, the goals of content understanding and developing thinking are concurrently pursued. 'In the context of teaching thinking, it means that the teaching of curricular content is infused with explicit instruction in thinking, with developing understandings of the kinds of thinking that might be required and with being strategic and self-regulatory about one's own thinking' (McGuinness 2005).

3.5 What is infusion?

The infusion approach is usually associated with the work of Swartz and Perkins and, more recently, Parks and Fischer. 'Infusion' was the term used by Swartz and Perkins in their book entitled *Teaching Thinking: Issues and Approaches* (Year?). They described it then as 'infusing teaching for thinking into regular classroom instruction by restructuring the way traditional curriculum materials are used' (Swartz & Perkins'1989, p. 68). At the same time, Swartz, Fischer and Parks (1998, p.3) describe infusion 'as an approach to teaching thinking which is based on the natural infusion of information that is taught in the content areas with forms of skilful thinking that we should use every day to live productively.' It is natural that all people think, but not skilfully. Skilful thinking needs to be learnt explicitly.

Swartz and Perkins (1989, p.3) differentiate between better thinking outcomes and processes. In terms of outcomes, they list the following: more reliable conclusions, deeper insights, sounder decisions, more finely crafted products, more creative inventions, and keener critical assessments. In process terms

Swartz and Perkins (1989, p.4) think that better thinking considers more possibilities, explores farther and wider, exercises keener judgment, marshals more data, challenges assumptions, exercises precision, checks for errors, and maintains objectivity and balance.

It is necessary that schools offer students the opportunity to be involved in activities that yield such outcomes. Students need to practice different thinking skills that enable them to produce sounder decisions and solve their problems in the future.

3.6 Why Infusion?

Which comes first: thinking or content? Swartz and Perkins (1989) answer this question discussing two hazards and suggesting a help. The first hazard is that we have to teach content first and when student acquire a considerable base knowledge they become ready to practise thinking. The second hazard is that we start with thinking then we move to content. They suggest a solution to overcome these two hazards 'When thinking and content are learned together, the thinking illuminates the content and vice versa' (Ibid. p.29). Swartz, Fischer and Parks (1998, p.2) list three main principles which provide a basic rationale for infusing critical and creative thinking into content instruction.

- The more explicit the teaching, the greater impact it will have on students.
- The more classroom instruction incorporates an atmosphere of thoughtfulness, the more open students will be to valuing good thinking.
- The more the teaching of thinking is integrated into content instruction, the more students will think about what they are learning.

From my experience in teaching thinking skills, I can add three more reasons for infusion. The first is that the school time table is crowded and no place for a separate thinking programme. Also, a separate programme means extra money for teaching material which will be resisted by many administrations. The second reason is that we and students spend thousand of hours studying the contents of school subjects, so why not make use of this time by also developing thinking skills? Finally, I noticed that students understand the content better. When thinking skills are infused, students become more involved and they have a purpose to learn. For example, when I asked my students to compare between

two stories, the answers were short and didn't show deep understanding. But when I started to apply the infusion approach, the responses became varied, abundant and critical. In addition, their speaking skills become better because they are motivated to generate more ideas and opinions.

3.7 The Ingredients of Effective Infusion Lessons

Swartz and his colleagues wrote a number of books which have many model lessons. These books have detailed explanation of the different ingredients that every lesson should have. The four ingredients are: (a) explicit strategies for skilful thinking, (b) collaborative thinking activities, (c) metacognitive reflection and (d) transfer. Swartz, Whipple, Blaisdell and Kiser (1999, p.1) point out that

These lessons blend together a cluster of well-researched instructional practices into what we feel is the most powerful way to instruct students so that they achieve a deep understanding of the content they are learning and develop habits of skilful thought that will serve them all of their lives.

a) Making Explicit What Goes Into Skilful Thinking

In comparing two stories, the teacher writes the important questions that students must identify when thinking about how the two stories are different or similar. These questions create an explicit verbal strategy for comparing and contrasting. They will guide the students' thinking explicitly as they engage in the compare and contrast lesson. This 'guide' is called a thinking map of comparing and contrasting. 'The map defines a cluster of ideas about what is important to focus attention on—what questions are important to answer—in skilfully engaging in [comparing and contrasting]' (Swartz , Kiser and Reagan 1999 ,p.2).

Open Compare and Contrast

1. How are they similar/alike?
2. How are they different?
3. What similarities and differences seem significant?
4. What categories or patterns do you see in the significant similarities and differences?
5. What interpretation or conclusion is suggested by the significant similarities and differences?

Swartz, Kiser and Reagan (1999, p.89)

It happens many times that people chose the wrong thing because their thinking was not skilful. The thinking map helps them avoid such problems because the questions make them think skilfully about many different aspects that they do not think about without using a thinking map. There is a thinking map for each thinking skill. But, how does infusion see the range of thinking skills which can be taught? Swartz, Fischer and Parks (1990, p.6) include a chart of the thinking skills and processes featured in the infusion approach.

The chart shows us that the infusion approach distinguishes between thinking skills, which are based on clarification and understanding (deep understanding and accurate recall), critical thinking(critical judgment) and creative thinking(original product), and the two thinking processes, which are problem solving and decision making.

In this approach, we restructure the content of lessons to teach a specific thinking skill based on the thinking map of that skill. All the activities in the lessons are determined by thinking maps. It is important for both the teacher and the student to be aware of the role of the thinking map because they have the basic strategies for teaching these kinds of thinking. Graphic organizers are used by students to write their ideas (see appendix A). They contain the questions in the thinking map in the same sequence. They help students to be organized in their thinking. I found the suggested organizers of great help. I made some changes in the format or by adding or deleting some words to suit my students. It is possible to design different types of organizes according to the level of your students and goals. It would be a good idea to ask your students to take part in designing these organizers.

b)- Collaborative Thinking

Two Heads Are Better Than One

Students have to understand that they can generate creative ideas and better solutions, etc. if they practice collaborative reflection. Johnson and Johnson (1983) 'found that when students work cooperatively in groups, increased reasoning strategies and greater critical thinking competencies result than in

competitive or individualistic settings' (cited in Costa & Lowery 1989 , p.17). Cooperative learning and critical reflection are natural allies. This message is stressed by (Swartz, Kiser and Reagan 1999, p.5.) who think that 'Collaborative thinking activities are also practiced in these lessons to give students an important message: teamwork in thinking through issues is not only acceptable; it is to be preferred over more individualized thinking tasks.'

Swartz and his colleagues employ many structures to engage content learning besides giving students the chance to practice the thinking strategies they are learning. I found the structures developed by (Kagan 1994) to be effective in making all students get involved in the process of learning and practicing the various thinking skills. Using these structures enables students acquire and develop thinking skills while mastering traditional subject area content. He talked about more than 200 structures of cooperative learning in his book 'Cooperative Learning'. In chapter '11' he talks about the structures that can be used in teaching thinking (see appendix B). He identifies six types of thinking skills structures: generative, reflective, relational thinking, analytical thinking, concept attainment, application categorizing, question generation and response.

c) - Metacognition

'The main thinking-skill goal of infusion lessons is to help students to internalize thinking strategies- mainly question and answer strategies--- that makes their thinking more skilful ' (Swartz, Kiser and Reagan 1999, p.5.). Metacognition or thinking about thinking forms an important part in infusion lessons. Swartz and Perkins (1990) use the term 'metacognition' to refer to 'one's knowledge about, awareness of, and control over one's own mind and thinking. It is used in infusion lessons as a mechanism for helping students to take control of their thinking by learning to monitor and guide themselves. Students are trained to reflect on their thinking by answering a number of questions like: What do we call this kind of thinking? What questions did you answer? Where did you write the answers? Why? What is the difference between this way of thinking and the way you applied in the past? Would you use this method in the future? Why?, etc.

Costa and Lowery (1989, p. 46) highlight the value of metacognition. They assert that 'If teachers wish to develop effective thinking and intelligent behaviours in students, then their instructional strategies should be purposefully designed to develop children's metacognitive abilities.' They (1989, pp.47-50) suggest a number of strategies for enhancing metacognition. These include: strategy planning, question generating, conscious choosing, taking credit, outlawing 'I cannot', paraphrasing or reflecting back students' ideas, labelling students' cognitive behaviours, clarifying students' terminology, role playing and simulations, journal keeping, discussing and evaluating thinking abilities admired in others and modelling.

It takes time and effort from students and teachers to internalize the mechanism and strategies of metacognition. This is what students need to have in order to be able to apply their thinking into other contexts by themselves. This leads us to talk about the fourth ingredient of effective infusion lessons 'transfer'.

d) - Transfer

After students think about their thinking, they need to apply the learnt thinking skills to similar and different situations. For example, after students compare and contrast two stories, they can compare the two main characters with little interference from the teacher. Later, students apply the same thinking skill in other subjects. Finally, students are asked to transfer these skills into other situations from real life. This 'far transfer' teaches the thinking skills in an authentic context similar to how thinking is used in real life. In this way we can avoid the transfer gap. This transfer gap is created because students are not engaged in the full range of life's situations. The structure of the infusion lessons provides a broad range of authentic situations to promote thinking and authentic transfer.

3.8 The Overall Structure of Infusion Lessons

Swartz and his colleagues devise a framework for teaching infusion lessons which encounter the four ingredients. Each lesson has four parts: introduction, thinking actively, and thinking about thinking and applying thinking. The

components of infusion lessons and a model lesson which I prepared based on Swartz' model lessons can be found in (appendix C and D).

Let's put on the red hat, I enjoy infusion lessons more than normal ones. I feel that I am organized. If we put on the yellow hat, teachers benefit from using this approach by understanding the content rather than memorizing it. The white hat informs us that a number of successful programmes worldwide like ACTS has adopted Swartz's infusion approach.

3.9 Activating Children's Thinking Skills (ACTS)

Carol McGuinness developed this programme with teachers in Northern Ireland in 1995. The programme aims to promote the development of thinking skills in ordinary classrooms in Northern Ireland. McGuinness (2000) explains the basic principle of ACTS

ACTS is based on the idea that if we want students to learn meaningfully, to think flexibly and to make reasoned judgements, then we cannot leave these important learning outcomes to chance. We must make clear what we mean by these types of thinking and then set out to teach them explicitly.

ACTS adopts the infusion approach associated in the USA with Robert Swartz and his colleagues. We can say that ACTS is a copy of their approach. In ACTS, teachers use thinking maps, graphic organizers and the same format of lessons discussed earlier.

4. How does teaching thinking effect students and teachers?

In the previous section, I outlined two of the better –known examples of approaches and programmes to teaching thinking. I now consider published evidence from evaluations of these programmes and some of the popular examples of tests to evaluate thinking.

4.1 Indicators and Tests of Better Thinking

Ennis and Norris (1989) identify eight commercially comprehensive critical thinking tests. In chapter three (40- 62), they describe these tests and comment on sample items. They identify eight tests based on general knowledge and another four commercial aspect-specific critical thinking tests.

Ennis and Norris (1989) point out the characteristics, advantages and disadvantage of these tests. From experience, it is a very complicated issue to claim that any one of these tests can give us a good picture about the achievements of students in practising and transferring thinking skills. You need to talk to your students to have a clear idea about their development. I agree with (Costa & Lowery 1989, p.61) who suggest that

the best way to gather evidence of student growth is for teachers to engage in "kid watching". ... Records of increasing voluntary and spontaneous performance of intelligent behaviour could provide more usable information about students' growth than the usual norm-referenced, multiple-choice standardized tests.

Fisher and Scriven (1997) in their book, 'Critical Thinking: It's Definition and Assessment' describe most popular thinking tests worldwide. It is of great benefit for those who are interested in assessing thinking. On the other hand, Costa & Lowery (1989) talk about fourteen characteristics of intellectual growth which teachers can observe and record. For example, persistence, decreasing impulsivity, listening to others with understanding and empathy, cooperative thinking and transference beyond the learning situation.

These indicators are important because they make teachers aware of the progress indicators that their students are expected to perform well. Students also need to be aware of them to monitor their behaviours. Parents, too, might be

encouraged to observe their children and report back to the school about the growth of these intellectual behaviours.

4.2 Does teaching thinking have an effect on teachers?

Teachers who teach thinking skills separately or infused can benefit from their practice in different areas. It is a good opportunity for personal and professional development. From my observations of my colleagues who practise teaching thinking skills, I have noticed that their intellectual behaviours are similar to the fourteen indicators of intellectual growth mentioned by Costa & Lowery (1989).

The Research Evidence in Education Library (REEL) (2002) publishes the results of its reviews of the impact of teaching thinking on teachers. The most significant results are changes in pedagogical practice and in attitudes towards pupils and implications for professional development. Similar results are stressed by McGuinness (2000). Teachers identify benefits for children's thinking. With regard to themselves, they note that 'ACTS had sharpened their own concept of thinking skills, enabled them to review their schemes of work and encouraged more effective planning. Some teachers emphasised the across-the curriculum effects and noted changes in the nature of classroom interaction.'

Those who apply De Bono's programme talk about many benefits for children as well as teachers. His site (<http://www.edwdebono.com>) includes a number of reports from different countries like Argentina and the Dominican Republic.

5. What conclusions can we draw?

The great number of thinking programmes may confuse many teachers. Which programme should I use? Why? First, teachers need to be aware of their central roles in making thinking programmes a success. Then, they can choose the programme that can help them play effectively their roles. In this section, I discuss the role of teachers and I suggest an eclectic programme for teaching thinking.

5.1 The Central Role of Teachers

'There is not adequate theoretical recognition that all which the school can do for pupils, so far as their minds are concerned is to develop their ability to think' John Dewey (1916).

Teachers play a crucial role in teaching thinking skilfully. In short, without appreciated, well trained and dedicated teachers, our efforts, excellent theories and techniques will be as someone digging his own grave (or airy fairy). As a teacher since 1983, I can say that many excellent projects aiming to apply the best theories in education have failed because teachers haven't played their central role for different reasons.

The same thing can be said about teaching thinking. I agree with Swartz and Perkins that 'Teaching for thinking will only succeed if it reflects wise choices based on a commitment to well-understood goals freely chosen by the professional who implements them' (cited in Costa & Lowery 1989 ,p. 9). The centrality of the teacher's role is emphasized by (J. J. Foley, 1971). He thinks that [teachers] 'have almost complete power over the process that takes place in the classroom. And it is my contention that process is more important than content in education' (cited in Costa & Lowery 1989, p. 11).

Teachers need to be given enough time to be trained well to develop students' intellectual abilities. There should be a well established programme for this purpose. One or two workshops will not have any valuable effect. Pre-service and in-service teachers must acquire the behaviours that can act as tools to enhance the intellectual development of students. These tools include techniques in class management, questioning, cooperative learning, meeting the different learning styles and multiple intelligences, observing students' intellectual

development, social interactions, etc. Costa & Lowery (1989, p. 13) in their book 'Techniques for Teaching Thinking' discuss several active-learning techniques that instructors can use to help students develop their thinking skills. They (1989, p. 13) identify seven instructional behaviours which have a direct influence on students effectively learning to think like class management, teacher's directions and questions, and the selection of content.

A teacher is responsible for creating a stimulating and supportive classroom climate. This can be accomplished by a set of behaviours which foster a climate conducive to the development of thinking skills. Thacker (cited in Cotton 1991) lists twelve recommended teacher behaviours, for example: setting ground rules well in advance, providing well-planned activities, showing respect for each student and modelling thinking skills

Applying these strategies, teachers become mediators of learning. Students must take an active role in learning rather than being passively taught. Teachers have to be guides on the side rather than sages on the stage. They will not encourage recitation or memorization. On the contrary, they will focus on generating ideas through discussion. They will help their students to be ready to live in the information age which needs people who can make use of the abundant information to generate innovative solutions and wise decisions to overcome the increasing challenges in the future.

Teachers can play their role effectively if the programme they are teaching has the necessary ingredients. Writers identify a variety of conditions that must be met for teaching thinking to be a success. For example, Nickerson *et al* (1985) summarize these conditions as follows: 'acceptance of the programme by the teacher, a clear statement of the aims, instruction and evaluation procedures, devoting sufficient time to a task, the training of transfer, the creation of a favourable classroom environment and working towards intrinsic motivation' (cited in Hamers & Overtom 1997, p. 26).

Many teachers want to teach thinking because they have realized its importance. They think that they cannot do that because the curriculum is not suitable. However, Williams and Burden (1998) who assert that

whatever the syllabus specifies, or whatever the worksheet contains, it is the way in which teachers methodologically mediate the curriculum that is significant. ...that it is only teachers with commitment to the need for a cognitive revolution within the curriculum who will effectively develop children's thinking abilities (cited in Burden & Williams 1998, p.193).

5.2 Building and Enhancing Skilful Thinking (BEST)

As a teacher of thinking skills, I believe that many programmes can help in developing students' thinking. I have realized that all programmes have limitations and a perfect one is not out of question. In teaching students different thinking skills applying Swartz' or De Bono's approach, I found myself forced to integrate different techniques from these two approaches and others. The more you know about these approaches and others, the more integration you will use.

Fisher and Scriven (1997, p.4) who conclude that 'The mixture of an external, stand- alone course and an infusion approach thus appears to be much the best strategy'. Therefore, I suggest using an eclectic approach in teaching thinking skills. My approach is an infusion one that applies Swartz' principles. At the same time, I borrow ideas from De Bono to help me in infusing thinking skills into school subjects especially English. I call this approach **Building and Enhancing Skilful Thinking (BEST) (see appendix E).**

While teaching thinking, I found myself using ideas from different approaches. Most of my lessons were not pure; they were a mixture of techniques from Swartz, De Bono, Kagan and Gardner. This explains the ingredients of BEST. Here is an example illustrating what I have introduced. The intended skill is skilful problem solving (PS).

As was said before, in the infusion approach we use a thinking map and a graphic organizer. The thinking map for problem solving is:

Skilful Problem Solving

- Why is there a problem?
- What is the problem?
- What are possible solutions to the problem?
- What would happen if you solved the problem in each of these ways?
- What is the best solution to the problem?

Swartz, Fischer and Parks (1998, p.42)

Students will use a graphic organizer to jot down their answers. In answering the first two questions, I ask my students to wear the white hat or to use one of

Kagan's cooperative structures like Pair / Team discussion or Team Word Webbing. Sometimes, I divide the class to the dominant type on intelligence and ask each group to answer the question they prefer. One group could draw a picture (Visual/Spatial), the second group could role play (Bodily/Kinaesthetic) the answer, the third group could prepare a short talk (Verbal/linguistic) and the fourth group could think of a rhyme (Musical/Rhythmic).

In answering question two, you can use Kagan's structures like 4S Brainstorming or De Bono's (1986) famous tools in CoRT Four 'Creativity' like 'PO' and 'stepping stone'. These tools enable students to generate a great number of ideas. The green hat is useful for encouraging students to come up with many good ideas.

A teacher can use 'Think-Pair-Share' to answer question four by asking students to think of the possible consequences for a specified amount of time, and then form pairs to discuss their suggestions. Later, students are called upon to share their suggestions with the whole class. It could be a good idea to ask visual students to draw some of the consequences. The tool "C&S" (consequences and sequel) as used by De Bono (1986, pp.20-23) is very useful in motivating and guiding students to think of the immediate, short-term, medium-term and long-term consequences. When asking students to use C&S, you do not keep reminding them of the different kinds of consequences; they will do it spontaneously and skilfully. Those who have logical /mathematical intelligence enjoy answering such questions.

The final question demands a decision or a judgement. So, the blue hat can be used to select the best solution. CoRT Two 'Organization' can be of great help especially lesson ten 'Conclude'. In this lesson, students learn to 'make effort to find a conclusion' (De Bono 1986, p.39). In other words, they try to answer: What is the conclusion?

In writing the answers, we vary our techniques by asking students to work in pairs, groups and individually. Usually, I prefer to ask students to work in groups during the practice stage. When I ask students to transfer their thinking into real life situations or during the metacognitive stage, they work individually. Then, in

pairs to compare their answers and finally with the whole class. In this way, the needs of both the interpersonal and intrapersonal students are met.

It is expected that if teachers can integrate the ideas of De Bono and Swartz, they can make learning thinking skills a fun that enhances both academic achievements and intellectual growth. Only by integrating many ideas from different approaches, teaching thinking might be difficult with little value and impact despite the studies and reports by the developers of these approaches.

CONCLUSION

Teach your students to think....
And you'll teach them to succeed
Edward De Bono

It is clear that psychologists and educators are in favour of teaching thinking skills either separately or infused into content. It has been proved by many writers and research centres that thinking is a teachable and a learnable skill. The merits of teaching thinking skills are also highlighted by many studies in different countries. So, children have the right to learn and practice thinking skills in order to prepare them to be creative and critical citizens who will build the future for the whole society. Educational systems must focus primarily on teaching youth how to think rather than what to think.

In order to achieve our goals as educators, all people in the society have to take part in making this process a success. Teaching thinking skills must be an important ingredient in the vision and mission of all state and private sectors. We will not succeed in our mission unless we have dedicated and well trained teachers, engaged and respected students and interested family. Finally, failure to help students develop higher-order thinking skills will seriously limit their ability to manage effectively in an increasingly complex-technical society.

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Appendices

Appendix (A)

School Name: _____

Grade

Date: / /

Open Compare and Contrast		
How A like?		
How Different?		
with regard to		
Patterns of significant similarities and differences		
Conclusion		

Appendix (B)

We [Kagan] have developed a range of instructional strategies called *structures* to develop each of the 15 fundamental thinking skills:

Kagan Structures for Thinking Skills

Thinking Skill Possible Structures Recalling

- Flashcard Game
- Showdown
- Spin-N-Review
- Send A Problem
- Numbered Heads
- Stand and Share
- Find Someone Who
- Rotating Review

Summarizing

- Idea Spinner
- Spin-N-Think
- Telephone
- Paraphrase Passport
- Three Step Interview

Symbolizing

- Symbolizing
- Formations
- Think-Draw-RoundRobin

Categorizing

- Similarity Groups
- Think Pad
- Brainstorming/RoundRobin
- Team Word Web
- Sequencing
- Pairs Compare

Role-Taking

- Value Line-Ups
- Paraphrase Passport
- Match Mine
- Mix-Pair Discuss
- Timed Pair Share w/Response Gambit

Analyzing

- Same Different
- Jigsaw Problem Solving
- Sequencing
- Match Mine
- Spin-N-Think

	Applying
<ul style="list-style-type: none"> ▪ Team Pair Solo ▪ Stir the Class ▪ Numbered Heads Together 	
	Inducing
<ul style="list-style-type: none"> ▪ Find My Rule ▪ Think Pair Share/Square 	
	Deducing
<ul style="list-style-type: none"> ▪ Mix-Pair-Discuss ▪ Numbered Heads Together ▪ Stir the Class ▪ Team Discussion with Roles ▪ Inside-Outside Circle 	
	Problem Solving
<ul style="list-style-type: none"> ▪ Co-op Projects ▪ Jigsaw Problem Solving ▪ One Stray ▪ RoundRobin 	
	Brainstorming
<ul style="list-style-type: none"> ▪ Brainstorming ▪ 4-S Brainstorming ▪ RoundRobin ▪ Think Pad ▪ RoundTable ▪ Pairs Compare 	
	Synthesizing
<ul style="list-style-type: none"> ▪ Team Statements ▪ RoundRobin/RoundTable 	
	Predicting
<ul style="list-style-type: none"> ▪ Inside-Outside Circle ▪ Numbered Heads Together ▪ Corners ▪ RoundRobin 	
	Evaluating
<ul style="list-style-type: none"> ▪ Proactive Prioritizing ▪ Timed Pair Share ▪ Spend-A-Buck ▪ Spin-N-Think ▪ Find the Fib 	
	Questioning
<ul style="list-style-type: none"> ▪ Spinners ▪ Three Step Interview ▪ Who Am I? ▪ Team Interview ▪ Q-Matrix 	

Appendix (C)

INFUSION LESSONS—LANGUAGE ARTS WHAT IS INFUSION?

COMPONENTS OF INFUSION LESSONS	
<p>INTRODUCTION TO CONTENT AND PROCESS</p> <p>Teacher’s comments to introduce the content objectives</p> <p>The lesson introduction should activate students’ prior knowledge of the content and establish its relevance and importance.</p> <p>Teacher’s comments to introduce the thinking process and its significance</p> <p>The lesson introduction should activate students’ prior experience with the thinking skill/ process, preview the thinking skill/process, and demonstrate the value and usefulness of performing the thinking skillfully. The introduction serves as an anticipatory set for the thinking process and should confirm the benefits of its skillful use.</p>	
<p>THINKING ACTIVELY</p>	
<p>Active thinking prompted by teacher questioning and graphic maps</p> <p>The main activity in the lesson interweaves the explicit thinking skill/process with the content. This is what makes the content lesson an infused lesson. Teachers guide students through the thinking activity by using questions phrased in the language of the thinking skill/process and by using graphic organizers.</p>	
<p>THINKING ABOUT THINKING</p> <p>Distancing activities that help students think about the thinking process</p> <p>Students are asked direct questions about their thinking that prompt them to reflect about what kind of thinking they did, how they did it, and how effective it was.</p>	
<p>APPLYING THE THINKING</p> <p>Transfer activities that involve student-prompted use of the skill in other examples There are two broad categories of transfer activities: (1) near or far activities that immediately follow the substance of the lesson and (2) reinforcement of the thinking later in the school year. Both types of transfer involve less teacher prompting of the thinking process than in the Thinking Actively component of the lesson.</p> <p>Immediate transfer</p> <p>Near transfer Application of the thinking process within the same class session, or soon thereafter, to content similar to that of the initial activity in the lesson. Decreased teacher prompting of the thinking is involved.</p> <p>Far transfer Application of the thinking process within the same class session, or shortly thereafter, to content different from that of the initial activity in the lesson. Decreased teacher prompting of the thinking is involved.</p> <p>Reinforcement later Application of the thinking process later in the school year to a variety of both near and far transfer contexts. Teacher prompting of the thinking is at a minimum.</p>	

Appendix (D)

INFUSING THINKING INTO INSTRUCTION- Compare and Contrast A model Lesson

The Storm / Gloria Estefan	
ENGLISH	GRADE
School:	
Teacher's name: Mohammad Assaf	
OBJECTIVES	
CONTENT	THINKING SKILL/PROCESS
Students will read two stories (The Storm / Gloria Estefan) and employ the comprehension skills of main idea, supporting details, setting, drawing conclusions (lessons we learn), describing characters, and making inferences.	Students will skilfully compare and contrast information by determining significant similarities and differences between two stories and drawing a conclusion based on their comparisons.
METHODS AND MATERIALS	
CONTENT	THINKING SKILL/PROCESS
Students will read the two stories "The Storm / Gloria Estefan". Cooperative learning as well as independent learning will be utilized.	A thinking map, a graphic organizer and structured questioning emphasize a thinking strategy for open compare and contrast .Collaborative learning enhances the interchange of thinking.
LESSON	
INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS	
How many of you read stories or books? Think about two of your favorite stories or books. Do they have anything in common? Think of some ways in which they are the same and write them on your paper.	
What were some of the differences? T. allows students time for writing.	
Now, what can you say about the stories you described based on the similarities and differences? Draw some conclusions about them. Remember, conclusions do not repeat the similarities and differences, or say simply that they are alike and different. Conclusions tell us something new that is suggested by the similarities and differences. Allow students time to discuss and report back.	
<p style="text-align: center;">Open Compare and Contrast (Thinking Map)</p> <ol style="list-style-type: none"> 1. How are they similar/alike? 2. How are they different? 3. What similarities and differences seem significant? 4. What categories or patterns do you see in the significant similarities and differences? 5. What interpretation or conclusion is suggested by the significant similarities and differences? <p>What you've been doing is comparing and contrasting. It is a natural inclination that we all have when we are thinking about two people or things. How many times have you discussed with your friends why you think a story is boring? Here is a thinking map that outlines the most important questions to ask when you compare and contrast. You will notice that there are more than two questions. What is their third thing we ask? (Possible student response question 3) For example, it might not be important to know the weight of the main characters or the name of his mother or his favorite food, etc. What is the 4th thing we ask about? (Possible student response question 4) We classify these similarities and differences into categories. For example, when we talk about two characters we may talk about (appearance, hobbies, favorite things, etc.) What do you notice about the 5th question? (Possible student response question 3) When you tell your friend which story is more interesting, you're drawing a conclusion, aren't you? Students should respond in the positive. Keep this thinking map in mind as we compare and contrast.</p>	
***Today I am going to read two stories for you: The Storm & Gloria Estefan. They talk about two women . Gloria Estefan and "The Storm ". You will need to listen carefully as I read, because you will be expected to recall details from the two stories for our thinking and writing activity.	
THINKING ACTIVELY	
***There are characters in the two stories. Who are they? Gloria, woman , etc.	

*** What happened to each woman?

*** Just like the two famous people you compared and contrasted, these two stories have similarities and differences. We are going to use a graphic organizer for OPEN COMPARE AND CONTRAST to look at these two stories more closely in order to better understand them. Pass out the OPEN COMPARE AND CONTRAST graphic organizer to everyone and allow time for names to be written on papers. (Pencil is preferred so that students may erase.)

*** With your group, identify as many similarities as you can that both stories share and write them on your graphic organizers. It is important that all of you record the similarities because you will need this graphic organizer for future reference. Allow time for students to record several similarities . T. elicits the answers. Ask for only one similarity per student and record the response on a transparency or the board. Be sure to ask questions that cause the student to think more carefully about each response they give. Questions of cause and effect, implications and clarification extend not only the thinking but also the comprehension as well. Students can add any similarities they can see on the board to their own list. . Possible student response: Both talk about animals; a wolf in each story , the wolf is cunning , one character in each story is clever; happy end , short ;

Now think of ways in which the two stories are different. Write the differences on the graphic organizer under the title "How different?" You will notice that there is a centre box. Above these boxes what does it say? **With regard to**. Let's see if we can figure out what this is for? One of the ways in which the two stories are different is that we have one person in "The Storm" while we have a number of people in the "Gloria Estefan". What would be the category for this? Characters. So underneath "The Storm" we would write "woman and under "The Gloria Estefan", we would write Gloria , Emilio , Mother , Band , Father , and in the "With Regard To" box that connects them we would write " Characters". T. demonstrates this by writing this on the board or the transparency as he explains. With your group, fill in the " How Different?" section of the graphic organizer. Remember to write the category of the differences in the box between the two side boxes. Allow student time to write the differences between the two stories.

*** How are the two stories different? As T calls on individual students , he asks extending questions about the causes and effects, implications, or significance of the differences between the two stories. Students should add any difference that they find interesting or significant.

****Look over your graphic organizer. Do you see any similarities and differences that might not be very important? We want to base our understanding of the two women on significant ideas. For example, the fact that they are both women might not be as significant as the fact that they both loved adventures. Take a few minutes to mark out those you consider to be not important. **Give students a few minutes to look over their graphic organizer.**

*** Did anyone mark anything out? Why do think they are unimportant? T. emphasizes that these are their ideas and each graphic organizer may be different.

***Think about all of the similarities that you have written down. Do you see any patterns that have developed? Take a minute to look over your graphic organizer and write down a few patterns that you find.. These patterns are big ideas or ideas that occur over and over.

*** Based on the comparing and contrasting that you have just done, think about what you have learned about Gloria and the woman in the Storm. The last box of the graphic organizer calls for an interpretation of the information that you have thought about. Write a sentence(s) that expresses the conclusion suggested by the comparison you have done about these two girls and their similarities and differences you have written down.

*** We are going to do an activity now in which each of you will have a partner. When you have your partner, I will continue the directions. Decide on which one of you will be NUMBER 1 and which will be NUMBER 2. We are going to " THINK-PAIR-SHARE". This is an activity where you each will be given the opportunity to read your sentence while your partner listens. The role of the listener is to assist his partner to express the conclusion more clearly. The listener may only ask questions:

***** Questions of clarification: What did you mean when you wrote.....?

Questions of elaboration: Can you tell more about.....?

Questions of challenge: (your friend if off track or is confused) Why did you think.....? You want your

partner to rethink the sentence and not to take your question personally.
** Number 1. you will be the listener and Number 2 you read your conclusion. In about 2 minutes you will change roles. Ps are given the opportunity to rewrite their conclusions. Ask for volunteers to read their sentences to the class. Have volunteers share their conclusions with the rest of the class.
THINKING ABOUT THINKING
*** What do we call the kind of thinking we just did? Comparing and contrasting.
*** What questions did we ask as we did this kind of thinking? (The thinking map). What is the first question that we ask? Then what did we ask? What was the third question?
*** Is it good idea to compare and contrast this way? In what ways was this different than just thinking about similarities? (focuses thinkingwe think about the significance of similarities and differences
*** Do you think that this is a valuable way to think about how things are alike and different? Why?
*** How did the graphic organizer help you in the process? Organizing thoughts , focusing their thinking..... thinking more in depth reach a conclusion that is based on sound thinking.
Is looking at the parts to whole relationship useful/ helpful in understanding the story better? Do you think that we benefit from talking about this kind of relationship?
APPLYING THINKING
Immediate Transfer
Our 3 rd unit will be about jobs. Using open compare and contrast, we will determine the similarities and differences between two jobs(doctor / teacher), find patterns and draw conclusions about these two jobs.
On the 2 nd of December we will celebrate the 33 rd anniversary of the UAE National Day. We will use the strategies for open compare and contrast the life in the UAE before and after 2/12/1971.
Reinforcement Later
Compare and contrast between Dubai and Abu Dhabi. Compare and contrast your father/ brother and mother/sister.
Writing Extension
Students are encouraged to write a two –paragraph essay using the graphic organizer as prewriting. The conclusion sentence should be used in the opening paragraph.
Suggested Special Needs Modifications
Frontload: Making conclusions is often challenging to some students. Therefore, prior introduction to using information to make an inference will be necessary for these students.
Diversify: Oral interaction with some students who need help can help them articulate what they have written.
ASSESSING STUDENTS THINKING ABOUT PARTS-WHOLE RELATRIONSHIPS
Students should complete a graphic organizer utilizing two things from a content area. Then they have to write a two paragraph essay with the graphic organizer as a prewriting activity.

Appendix E: A summary of the main features of BEST

What is BEST?

BEST is based on the infusion approach which is usually associated with the work of Professor Robert Swartz (Director, The National Centre for Teaching Thinking, USA) and his colleagues. Swartz and Perkins (1990, p. 68) describe infusion as 'infusing teaching for thinking into regular classroom instruction by restructuring the way traditional curriculum materials are used.' I also believe that 'the mixture of an external, stand- alone course and an infusion approach ... appears to be much the best strategy' (Fisher & Scriven 1997, p. 4). Hence the BEST program includes a number of de Bono's thinking tools.

In brief:

- BEST is based on the belief that students have the right to learn thinking skills to be optimally motivated to learn.
- BEST has adopted an infusion approach to develop thinking skills across the curriculum by teaching them explicitly.
- BEST recognizes that pupils must be given the time and opportunity to apply different thinking skills and learning techniques and tools from various programs.
- BEST builds on the idea that infusing thinking skills into the curriculum has positive impacts on learning a second language.
- BEST views writing as a thinking process that requires students to practice creative and critical thinking.
- Overall, BEST attempts to develop a "thinking curriculum" in schools that believe that all students can be good thinkers

Why infusion?

- The more explicit the teaching, the greater impact it will have on students.
- The more classroom instruction incorporates an atmosphere of thoughtfulness, the more open students will be to valuing good thinking.
- The more the teaching of thinking is integrated into content instruction, the more students will think about what they are learning.

What Kinds of Thinking Skills?

Students practice thinking skills that aim at

- generating ideas through generating possibilities,
- clarifying ideas through compare/contrast and
- assessing the reasonableness of ideas through prediction.

What are the Targeted Thinking Skills?

During the project, students will practice using: compare and contrast, part/whole relationship, decision making and problem solving.

Teaching Thinking Explicitly

Teaching thinking explicitly requires teachers to prepare well for their lessons. The four main components of infusion lessons are: introduction to content and process, thinking actively, thinking about thinking and applying the thinking. Teachers restructure the content of lessons to teach a specific thinking skill based on the thinking map (a structured list of key questions) of that skill. Graphic organizers are used by students to answer these questions. They are structured to guide students through the process of thinking.

Writing Process

Process writing helps students become independent writers and deepens their thinking. Student will be trained to apply the five stages of writing process: prewriting (planning), writing (drafting), rewriting, editing and publishing.