

MODELS OF THINKING EDUCATION AND QUADRUPLE THINKING

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ABSTRACT

Many researches have been carried out into thinking education. In the basis of these studies lie two basic ideas. One of them is to prepare a special program for thinking education and the other one is to embed thinking education into a certain curriculum. Examples for such programs are CoRT (Cognitive Research and Trust), H.O.T.S. (Higher-Order Thinking Skills), Feuerstein's Instrumental Enrichment (F.I.E.), Philosophy for the Children, Tactics for Thinking, Structure of the Intellect (SOI), The Thinking/Learning (T/L) System and Odyssey of the Mind etc. however, almost none of these models present a proposal for concerning general educational system. In the current study, the similarities and differences between Quadruple Thinking and that other thinking models are discussed.

Key Words: Quadruple thinking, teaching thinking, philosophy for children, thinking education.

THINKING EDUCATION

What thinking really means has been a point of discussion for centuries. Transformation of education into an independent science, together with other sciences, made thinking the subject of education. Thinking, as the subject of education, is in the core of the essential topics of pedagogy such as the approaches, theories and philosophy of education, being in the first place, as well as teaching and learning, development, curriculum development, and assessment and evaluation. One of the reasons why education is rather sensitive about thinking is implicitly related with what John Searle holds "If you cannot say a thought clearly, it means you do not understand it yourself". Therefore, the aims of thinking education is both to say a thought precisely and to understand the thoughts of others, starting with our own thoughts. To understand our own thoughts and the thoughts of others requires the effective application of thinking automatically.

Finding out what thinking really means is a mental activity which could solely be grasped by the person himself. For such a mental activity to take place, the person must be ready, and indeed this is also a special effort (Heiddeger, 2004). This mental activity, a special effort, is not perceived by others, it is just special to the person. Also the awareness of one's own mental state and mental processes belong to the person himself. The person lives of two personal historical processes, the first of which is in his and is about what is happening to his body, and the second is the mind and concerns what is going on in the mind. The first one is obvious, while the second is rather private (Ryle, 1963). As can be understood from the statements of Heiddeger and Rylee, thinking is an individual activity. Therefore, any education and training activity on thinking should not only be general so as to teach the individual the act of thinking but also private to make personal awareness visible. It is possible to adopt three different approaches to models of thinking education which have been designed to meet these expectations; put forward thinking training models; specially designed ones, those associated with curricula, and the ones that are linked to a specific topic (Wilson, 2000).

It is possible to evaluate the models associated with curricula together with the ones that are linked with a specific topic. These models are discussed in the context of a course or a subject. The specially designed models

are those that are developed independent from curricula or a specific topic and aim to help students gain the thinking skills as foreseen in the model. Therefore, it would not be wrong to address these approaches grouped under three titles under two main headings; models that are independent from content and models that are related to a specific content. Both approaches have advantages and disadvantages. The models that are independent from content improve the thinking skills themselves, yet they are limited in terms of establishing a link with the content. On the other hand, the models associated with content develop thinking skills to handle a variety of content, but they are limited at the point of developing thinking skills which cannot be linked to specific content.

Ways of thinking includes "perspective". All skills, styles, and instruments are arranged to develop this perspective. Therefore, creative or caring thinking or visual thinking can be considered as a field in which the perspective of thinking is placed at the centre. From another aspect, ways of thinking are the most "general" structures which lay out the theoretical and academic point of view as regards thinking.

Thinking skills include "competencies". Competencies necessary to perform the act of thinking are the elements that ensure a common language and its definitions, professionalism, level and order. These elements give the opportunity to compare the nature and quality of thinking. Whichever way of thinking is considered, competencies need to be developed in line with the specific way of thinking and "thinking skills" that will help develop these competencies should be defined.

Thinking styles, on the other hand, contain "habits". Style is the way a person prefers when using his skills. In other words, style is an indication of how thinking skills are activated and point out to the style of preference rather than thinking skills, competencies, and even abilities. Style can essentially be defined as an approach or a trend. The more objective the kinds, skills or instruments of thinking are, the more subjective are thinking styles.

Thinking "instruments" are systematic and facilitating factors that open our minds. They could rather be regarded as the tools of strategies which will utilise perspectives and competence. Such instruments are supportive structures that could be used to improve the way, content, habit and competence of thinking altogether.

Table 1: Ways, Skills, Styles and Instruments of Thinking

Ways of Thinking			Thinking Skills		
GENERAL	Reflective Thinking	PERSPECTIVE	COMPETENCE	TEACHING	Focusing Skills Information Gathering Skills Remembrance Skills Organisational Skills Analytical Skills Generalisation Skills Integration Skills Evaluation Skills
	Convergent Thinking				
	Hopeful Thinking				
	Divergent Thinking				
	Logical Thinking				
	Positive Thinking				
	Systematic Thinking				
	Creative Thinking				
	Lateral Thinking				
	Innovative Thinking				
	Visual Thinking				
	Historical Thinking				
	Geographical Thinking				
	Mathematical Thinking				
	Holistic Thinking				
Caring Thinking					
Critical Thinking					

PREFERENCE	Analytical Curious Understanding Open-minded Systematical Synthesist Idealist Pragmatist Realist Flexible Organised Sharing Risk-taker Introverted Extraverted Elaborator Conservative Staging Judgemental Innovative Traditionalist	HABIT	STRATEGY	Explanatory Concepts Taxonomies Action - Reaction Concept Map Result Table Six Hats Graphic Editor Diamond Grading Fishbone Flowchart K-W-L (Knowing-Willing-Learning) Lotus Diagram Mind Map Multiple Intelligence Plus-Minus-Interest SWOT T Square Time Table Venn Diagram Y Square	METHOD
Thinking Styles				Thinking Instruments	

To address and implement the dimensions above, many training models for thinking have been developed and each one has shown an effort to gained a systematic structure. The main differences and similarities of these schemes become evident in the different use of elements such as the ways, styles, skills and instruments of thinking.

In this study, rather than the models associated with curricula or a specific topic, the specially designed ones are compared to the Quadruple Thinking Model. This comparison will be based on the main criteria of education itself, its system and human understanding and the framework is set out in Table 1.

MODELS OF THINKING EDUCATION

Numerous specialised programmes have been developed for thinking education. In this study, the most common ones will be addressed. It is therefore possible to list them as follows:

1. CoRT(Cognitive Research Trust) Lateral Thinking

CoRT is a thinking model which was initiated in 1969 by Edward DeBono and is one of the most widely used thinking models. Edward DeBono's model is among the education programmes for thinking which falls rather in the sphere of creative thinking and focuses directly on teaching skills. Developing a systematic and consistent approach in itself, this model considers, lateral and parallel thinking and their thinking instruments together.

DeBono pointed out to some differences between lateral thinking and vertical thinking: Vertical thinking is selective, while lateral thinking is generative. Vertical thinking moves towards a single point of motion, whereas lateral thinking generates different directions to move to. Vertical thinking is analytical; on the other hand, lateral thinking is provocative, inciting. Vertical thinking is sequential, while lateral thinking can make jumps from time to time. In vertical thinking, one has to validate himself in each step, but there is not such a necessity in lateral thinking. In vertical thinking, one uses the negative in order to lock off certain pathways, yet in lateral thinking there is no negative. Again, in vertical thinking one omits irrelevant concentrations, while lateral thinking welcomes coincidental interventions. In vertical thinking, categories, classifications and labels are mixed up, but in lateral thinking there is not such a case. Vertical thinking follows the most likely way, while

lateral thinking is more inclined to exploring the least likely. Finally, vertical thinking is a finite process, while lateral thinking is a probabilistic one (DeBono, 1977).

DeBono suggests parallel thinking as an alternative to Socratic Thinking and it is a resistance to conventional thinking approaches. In a traditional debate, both sides are conditioned to attack each other by taking positions. Both sides claim the falsity of one another's ideas and prove it. Traditional debate lacks configuration, creativity, and design. Therefore, it only strives to discover the truth rather than building something. In parallel thinking, on the other hand, there is a systematic of thinking based on cooperation and coordination developed in both directions (DeBono, 1995). The most typical example is the six hat thinking.

The system which is also called the instruments of thinking was named by DeBono as CoRT (Cognitive Research Trust). The Model consists of 6 chapters, each comprising ten lessons (Aybek, 2006) (DeBono, 2013):

Cort 1- Breadth: Lessons in this chapter have been designed to broaden the thinking/minds of students. In this way, the aim is to ensure that individual consider a situation or an incident from a wider perspective and see various and different sides of it.

Cort 2- Organization: The lessons in this chapter are related to the overall organisation of thinking. Such an intervention/initiative takes thinking out of its roaming and distracting course and regards in a whole frame of an organisation.

Cort 3- Interaction: Lessons in this chapter are more associated with the situation, conditions, etc. Of to people in general and aim to focus on the thinking of others rather than the topic that is being thought. One of its main objectives is to evaluate the evidence and justifications.

Cort 4- Creativity: Lessons in this chapter are more related to the more effective and creative thinking of an individual and his/her producing more alternatives. The type of creativity developed in CoRT-4 is the "design" type of creativity. Hence, the simple techniques, processes and objectives of creativity are more central.

Cort 5- Information and Feeling: In this chapter, there are lessons about the ways to reach and evaluate information in a practical manner, and about feelings such as beliefs, expectations and attitudes. In addition, the influence of feelings and values on knowledge is also addressed. The main aim here is not to change their impact but to raise awareness about them.

Cort 6- Action: Lessons in this chapter comprise activities aiming to improving the mental and intellectual skills of the individual. The main method is to simplify the process of thinking and eliminate complexities and confusion. All these lessons culminate in a lesson whose name consists of the initials of all the other lessons (TEC-PISCO which stands for Target-Expand- Contract- Purpose- Input- Solutions- Choice- Operations).

CoRT is a program which is rather related to creative thinking. The way of thinking, which was named by DeBono as Lateral Thinking can actually be considered as a new perspective to creative thinking. Therefore, rather than taking lateral thinking and parallel thinking as separate ways of thinking but rather the derivatives/forms of creative thinking. From this perspective, CoRT is almost a programme about a single way of thinking and it does not deal with multiple ways of thinking. The fact that DeBono does not place any emphasis on critical thinking, which is normally used widely, makes us wonder whether he considers it as vertical thinking or not.

In most of the studies on thinking, the Socratic Method is discussed as a recommended instrument of thinking which is considered to be effective. DeBono does not reject the Socratic Method; however, he maintains that it would be deficient in structuring thinking, and that it would remain just to take a side and attack each other, expressing that the only benefit is to reveal the truth.

DeBono's system is almost entirely based on the instruments of thinking discussed in the courses he called CoRT. With this aspect, it is by far the richest and most detailed programme among educational programmes in terms of instruments of thinking. 60 instruments of thinking comprising a total of 6 sections with 10 lessons in each section constitutes the roof of the programme.

There is insufficient emphasis in DeBono's system on the 'human', who perform the act of thinking. Human needs to be described as a being, his/her philosophical, psychological, sociological and historical dimensions should be emphasised. It is not very clear how thinking takes place in some basic philosophical subjects such as morality, art, science, assets, etc.. and how the psychological infrastructure is established in the context of cognitive and emotional balance. From this perspective, the system is the lack of these aspects. As the program is devoid of such explanations, it becomes extremely mechanical. The main focus is on the instruments of thinking which are considered in the scope of critical thinking rather than thinking skills or styles. This focus improves divergent thinking, while it fails to provide any explanation on convergent thinking.

2. H.O.T.S. Higher-Order Thinking Skills

H.O.T.S. programme was developed by Stanley Pogrow in 1982. It is designed to develop 4-8 grade, educationally disadvantaged student's thinking skills. The aim of the program is to increase the higher-level thinking strategies and relevant knowledge of the students. This program, aimed at promoting the process of thinking by using computers, drama and Socratic inquiry, is applied for 2 years (Pogrow, 2008).

HOTS aims to bridging the gap between the passive visual learning provided by computers and televisions and active verbal learning which is targeted in a regular classroom. For this purpose, it provides an interactive tool in order to test students' skills in oral expression. Although initially most students can not express their ideas, they have been observed to develop this skill over time. The program, in which drama is used, stimulates interest and curiosity in students sometimes due to the teacher's acting and sometimes because of his attire. The importance of Socratic inquiry in HOTS is the fact that it establishes creative and logical conversations between teachers and students. While many teachers ask simple questions mostly with one-word answers to disadvantaged students, teachers trained for HOTS ask these questions in a way that enables student to give more elaborate answers and provide explanations. According to one survey (Darmer, 1995). HOTS ensured improvement in students in six categories: basic skills, writing skills, metacognitive skills, grade average, IQ components and new problem solving skills.

The basic concepts of HOTS can be listed as; context, meta-cognition, procedural knowledge, understanding, creativity, insight, intelligence, problem solving and critical thinking (King et al. 2013). Views of scientists such as Piaget, Bruner, Bloom, Gagne, Marzano, Glaser, Vygotsky Haladyna, and Gardner lay the foundations of HOTS (King et al. 2013). Besides, Guilford's ideas regarding the structure of intelligence and Stenberg's triple intelligence theory also constitute the academic foundation of HOTS.

The Programme is realised on three levels (King et al. 2013). These are;

1. Prerequisites,
2. Bridge (connection of networks and operations/transmissions,
3. High-level thinking skills (situations-outputs-skills).

On these three levels, some special methods such as educative communication, structural scaffold, direct teaching, question-answer, feedback, teamwork, computer-aided communication (King et al. 2013).

The program considers critical thinking as a basic concept in itself and it does not address it as a way of thinking which reflects on the whole system. Although there is no emphasis on creative thinking, the views on the structure of intelligence have been adopted as the academic basis. At some points in the programme which mostly emphasizes cognitive structures – which are in the framework of instruments of thinking like the Socratic Method, drama, etc. – there is also some content about creative thinking. This program can be considered as one which utilizes some instruments of thinking rather than ways, styles or skills of thinking.

There is no main and fundamental field on which the program is based philosophically, psychologically, sociologically and historically.

3. Feuerstein's Instrumental Enrichment (FIE)

It was first developed by the Israeli cognitive psychologist Reuven Feuerstein and his colleagues during 1950s and 60s when they were working for Youth Aliyah, which could be defined as a placement agency and a project for migrant Jewish children and then it became systematic in 1980s (Maxcy, 1991). The focus of the programme is to raise autonomous teachers. The central concept of the programme is the necessity of cognitive learning experience and it was designed to develop cognitive functions required for academic learning and success.

FIE is one of the triple implementation systems of Structural Cognitive Modifiability and Mediated Learning theory. The other two are The Learning Potential Assessment Device, a dynamic evaluation tool and Modifying Environments, which provides a general frame.

The programme consists of 14 instruments. Each of these instruments are based on one or two mental functions such as comparison, spatial orientation, analysis, categorisation, deductive thinking, comprehension etc. The person does not have to have preliminary knowledge in order to be successful in these. It is a programme whose instruments are transferrable to curricula or other fields that do not fall into its context, and they could be used in problem solving situations. It helps students to develop strategies and studying habits where rules and principles can be generalised. In addition, it has some specific objectives such as eliminating cognitive deficiencies, acquiring information about FIE concepts and terms, improving introspective thinking skills, ensuring real motivation, transforming the student from a passive learner to an active generator of knowledge, etc. (Maxcy, 1991).

The main aim of instrumental enriching is to increase individual's social adaptation ability, as well as changeability of comprehension. There are six specific aims that help realise this main aim (Sasson, 2011); correction of deficient cognitive functions, improving vocabulary, generation of self motivation through habits, generation of insight and contemplation, creating task-related motivation, transformation from the role of a passive receiver to an active producer generating new knowledge from data.

The 14 FIE instruments developed to realise the above mentioned objectives can be listed as follows (IRI, 2014):

Table 2: Standard Levels and Instruments of Feuerstein's Instrumental Enrichment

Standard Level 1	Standard Level 2	Standard Level 3
Organisation of Dots Orientation in Space I Comparisons Analytical Preception	Numerical Progressions Illustrations Temporal Relations Family Relations Categories	Instructions Transitive Relations Syllogisms Representational Stencil Design Orientation in Space II Stencil Set (5 stencils)

This programme developed by the cognitive psychologist Feuerstein and his friends can be considered as a thinking programme centred on cognitive structures and learning. In that respect it is limited to cognitive structures and it does not refer to any specific way of thinking. There is no specific way of thinking it aims to develop either. It places emphasis on the instruments of thinking rather than ways, styles, or skills of thinking. Absence of ways, styles and skills of thinking bring about some challenges in determining the philosophy, logic, configuration and main objective of these instruments of thinking. Besides, the programme is not based on any understanding of human.

4. Philosophy for Children

Philosophy For Children (P4C) programme is an educational proposal. It aims at developing multi-dimensional thinking which involves critical, creative and caring thinking among children and young people and it is a

systematic and progressive programme that could be applied to the range between 4 year-old children and 18 year-old young people. The programme appeals to children's interests in general; its topics are provocative, the content is handled in a methodological way. High level thinking skills are developed a community of inquiry and doubt activates curiosity.

P4C, which was developed by American philosopher Matthew Lipman in 1969, is implemented in more than 50 countries. The programme does not aim to help students become professional philosophers, it aimed to maintain and at the same time improve their critical, creative and caring thinking skills. Its roots lie in John Dewey, Justus Buchler, Lev Vygotsky, Jean Piaget, Gilbert Ryle, George Herbert Mead, and Ludwig Wittgenstein (Naji, 201).

The main characteristics of the programme can be listed as follows (Accorinti, 2013):

- A series of philosophical texts written by philosophy specialists who bring together theory and practice and who are experts on P4C. These reading passages are mainly essentially based on well-known philosophical discussions.
- Teacher's guides written separately for each text not only plan for a number of discussions, but they also facilitate the achievement of programme objectives.
- It adopts a pedagogic method aiming at transforming the class into a community of inquiry.

P4C Programme is based on three modes of thinking. These are critical, creative and caring thinking. Lipman (2003) explains his views on this issue as follows.

Critical Thinking: According to Lipman, the outcomes of critical thinking present a judgement. Hence, it has the quality of "judgement". In this respect, critical thinking is not merely a process, but a way of thinking with applications. Rather than reaching an understanding, it is to do, to say, to produce something. The process of critical thinking and its main characteristics establish its relationship with judgement. At this point, critical thinking is a way of thinking which (1) facilitates (2) is based on some criteria (3) self-corrective and (4) sensitive to the context. At the same time, critical thinking can be defined as a self correcting and context sensitive way of thinking. It aims to eliminating the non-formative and implied fallacies. Another aspect of critical thinking is that it is based on criteria. A criterion can be defined as a rule or principle on which judgements are based. When we are selecting which criteria to use, meta and mega criteria help us.

Creative Thinking: Lipman uses the following concepts to define different characteristics of traditional thinking and creative thinking: originality, efficiency, imagination, independence, experiment, holism, expression, auto-transfer, productivity, maieutik. Creative thinking is an amplification way of thinking. It represents mental processes which are first illustrated by deduction amplify our thinking space and then which are illustrated by induction and is utilised through analogy and metaphor. The amplificative thought aims at going beyond data. In this respect, generalisations are indeed amplifications. And assumptions bear the representation of empowered and amplifying thinking. Analogical mind and metaphorical thinking are the other dimensions of amplification. Sometimes creative thinking becomes a type of thinking which defy rules and criteria. Another characteristic is that it gives birth. This quality makes creative thinking the midwife of intellectual thinking. Hence, creativity is bringing together the hidden pieces of knowledge in the mind and producing a different and original output, or thought.

Caring Thinking: We may not always realise to what extent our emotions shape and direct our thoughts and we may not be aware of the fact that our emotions actually provide a frame, a meaning, a perspective or a different outlook. Without emotions, thinking becomes plain and boring; thus, there is a crucial relationship between thinking and emotions. The subject is who establishes this link. Caring can be depicted as focusing on the object that we respect in order to appreciate its value. Caring thinking bears two meanings; one is to think curiously what the focal object of our thought is; the other one is to focus on someone's style of thinking. Lipman lists different aspects of caring thinking as follows: appreciative, sensible, active, normative and empathetic thinking.

Lipman defines the atmosphere in which these ways of thinking can be realised as “community of inquiry”. Community of inquiry makes it possible to address concepts like “speaking” and “dialogue”, which could be the expression of thought, in a more refined manner. In speech, the element of attention is strong, while the logical link is weak. In dialogue, however, it is the other way around. The greatest contribution of community of inquiry to the individual is the opportunity to learn from the experience of others and at the same time compare thoughts with other ideas and build on them.

Lack of sufficient association of Lipman’s model with pedagogy caused the philosophical aspect of the model become more dominant and visible (Dombaycı et al., 2011). In the frame of pedagogy and curriculum based education each piece of knowledge, skill, attitude and value to be associated with/linked with attainments. Manuals of curricula do not always state which pieces of knowledge, skills, attitudes and values are engaged, which constitutes another problem. In addition, it is almost impossible to use any materials other than the story books prepared for each level.

The fact that the programme predominantly involves philosophical inquiry requires philosophical formation and this makes it difficult for all subject teachers to handle the programme effectively. The tasks and operations related to measurement and evaluation are not specified precisely. These shortcomings cause the philosophical side of the programme to be more in the forefront. Nevertheless, despite all this criticism, it is one of the programmes that consider the act of thinking in an effective and holistic manner.

While ways of thinking are clear, elaborate and original, thinking skills, styles and instruments are complex. If the programme defines the ways of thinking clearly, it will be possible to develop skills, styles and instruments.

5. Tactics for Thinkink

Tactics for Thinking is a thinking skills programme which was initiated by a group of academicians under the leadership of Robert Marzano in 1985. It presents some tactics to strengthen and improve certain cognitive operations (Marzano, 1989). Students’ lack of self confidence in thinking is one of the central perspectives of the programme. The programme’s focus is “learning to learn”.

Tactics for Thinking programme aims to teach and promote the use of thinking skill in classrooms. Dimensions of Learning form the basis of the programme. The 22 thinking skills of the programme are classified into three categories (King & King, 2014): Learning to learn, considering the content, and reasoning.

Table 3: Tactics of Thinking Programme Skill Categories

Skills for learning/to learn	Skills for considering the content	Skills for reasoning
Attention control Deep procession Memory frameworks Power thinking Goal settings The responsibility frame	Concept attainment Concept development Pattern recognition Macro-pattern recognition Synthesising Proceduralizing	Analogical reasoning Extrapolation Evaluation of evidence Examination of value Decision making Non-linguistic patterns Elaboration Solving every-day problems Solving academic problems Invention

The programme is entirely based on thinking skills. 22 thinking skills are grouped under three main headings. Rather than the reflection of a single way of thinking, it focuses on the improvement of thinking skills. Focusing on a single way of thinking could be considered as a shortcoming; hence, Marzano defines the focus of the programme as “learning to learn” instead of teaching a single way of thinking. It is a cognitive programme and it does not deal with affective structures such as values and emotions. There is no gradation in the programme.

6. Structure of the Intellect (SOI)

Structure of the Intellect program was developed based on Guilford’s cubic “structure of the intellect in 1969 by MARY Meeker. It is designed for all primary school students and adults and is based on four principles (Meeker & Meeker, 2013): to know the principles of learning; to test formal, symbolic, and semantic competencies; to improve low competencies; compare performance levels within the classroom.

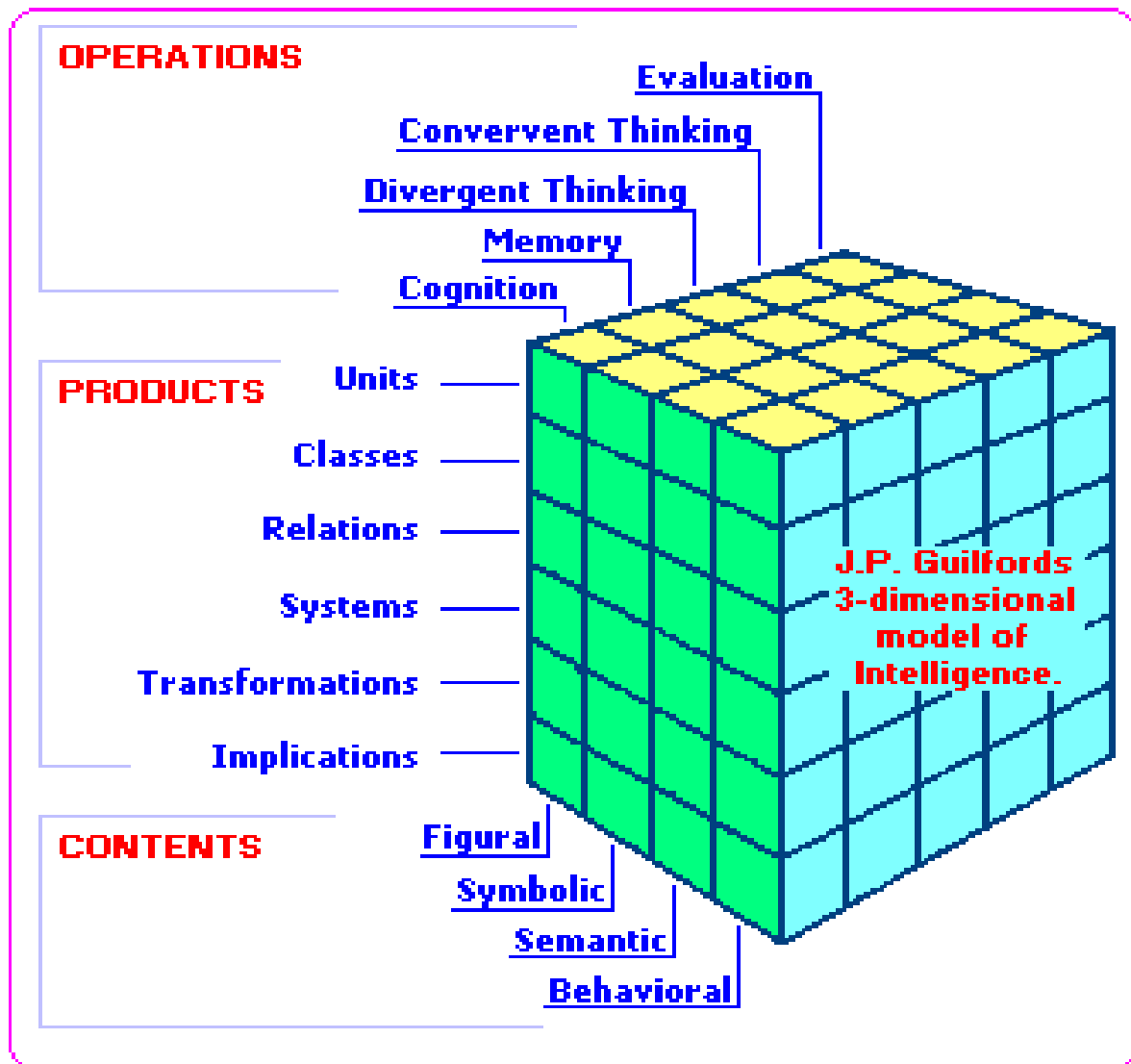


Figure 1: Guilford’s Theory of Intelligence

In Guilford's (1967) Structure of Intelligence (SOI) there are three main axis: operations, products and contents. As each one of these dimensions are independent, theoretically intelligence has 150 different components. Guilford developed psychometric tests to measure some special abilities that are estimated to be compatible with. These tests provide an operational definition of many abilities established by theory. In this frame, reasoning and problem solving skills can be categorized into 30 different abilities (6 products x 5 content).

Memory studies can also be divided into 30 different skills and sub-sections (6 products x 5 content). Decision making skills (evaluation studies) can also be divided into 30 different skills and sub-sections (6 products x 5 content). Linguistic skills can also be divided into 30 different skills and sub-sections (6 products x 5 content).

Dr. Mary Meeker, saw the potential in Guilford's studies and developed a model to be used in education. This model is successfully implemented in schools and it is quite effective in detecting learning deficiencies among students.

SOI is an intelligence-centered programme based on Guilford's studies. In this respect, it is possible to say that psychology is more active in this programme when compared with other fields. Apart from the intelligence and psychology context, another determining factor is the cognitive nature of the programme. It is not based on a specific way of thinking. In terms of intelligence and skills, approximately 150 skills are dealt with. The programme also addresses convergent and divergent thinking and there is no grade limitation. No specific instrument of thinking is mentioned.

7. The Thinking/Learning (T/L) System

Thinking/learning system is a thinking skills programme developed by Peter Edwards and Ervin Sparapani. It is designed for primary school students and adults. It is based on four high-level thinking skills: processing information, creative thinking, critical thinking and decision making.

Thinking/Learning (T/L) System is a programme which combines high-level thinking strategies and brain-based learning principles and aims to realising high-level thinking education. T/L System, as a teaching model, was developed by matching the levels in HOTS and Bloom's taxonomies. The system emphasizes brain based learning and strives to teach high-level thinking through activities.

The system allows the teacher to assign tasks to students according to their individual needs by urging them to use the right, left or all processes of the brain either separately or together when using specific thinking skills. When the programme is effectively implemented, the lesson comprises 12 separate activities selected by the teacher and students.

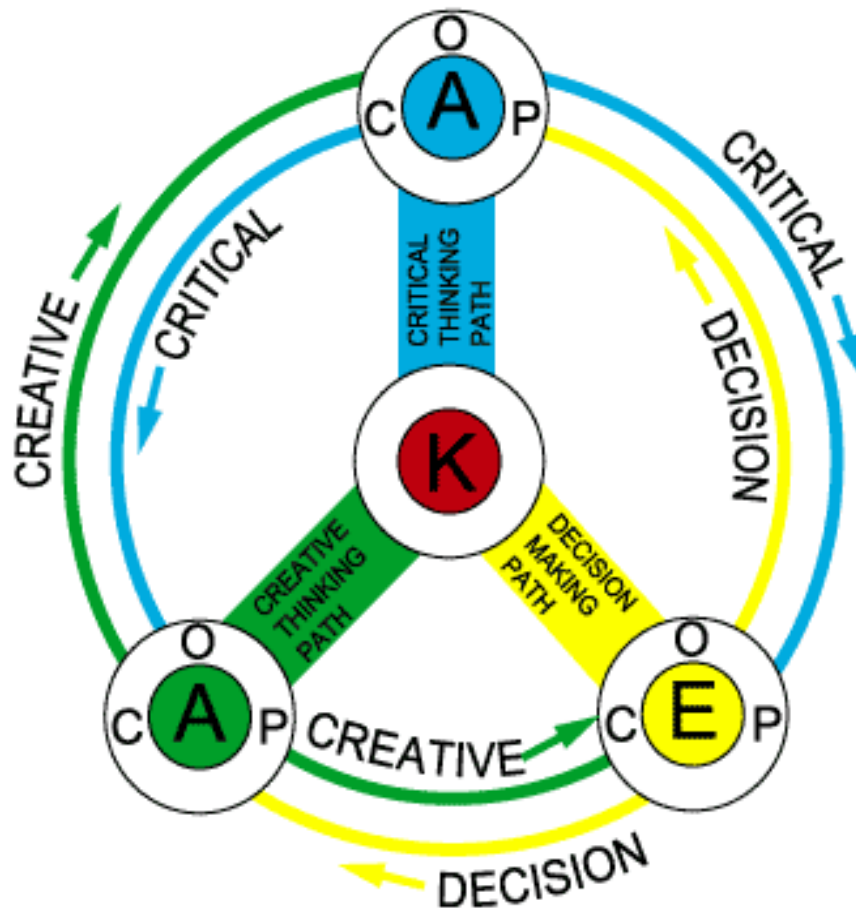


Figure 2: The Thinking/Learning (T/L) System Model (Sprapani & Calahan, 2013)

The T/L system was developed for any content, material or educational level. As illustrated in Figure 2, it has four loops: knowledge, analysis, application, evaluation. The letters in small circles, “C”, “O” and “P” stand for “content”, “outcomes” and “prosedures” respectively. It draws attention to the content of thought and processes utilised, as well as to how learning will be assessed (Sprapani & Calahan, 2013).

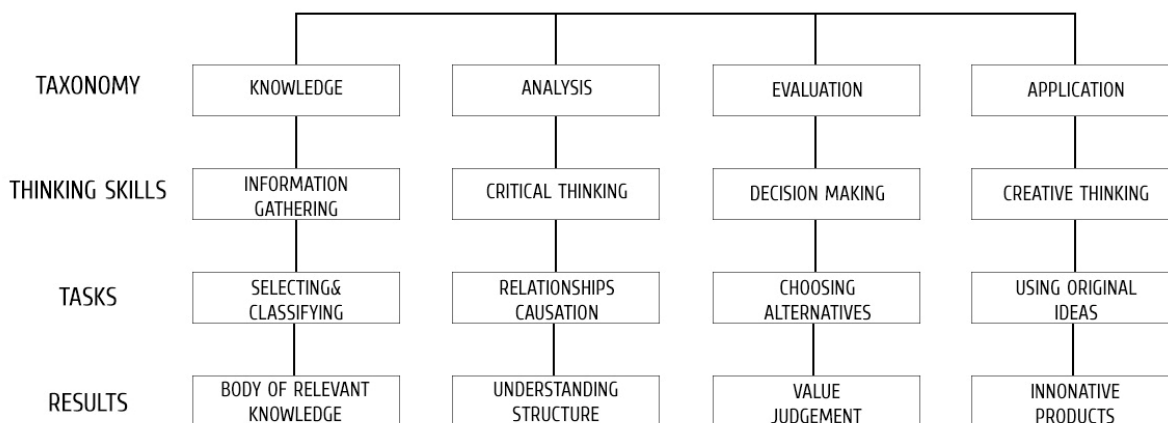


Figure 3: Conceptual Framework of The Thinking/Learning (T/L) System (Sprapani & Calahan, 2013).

Figure 3, on the other hand, demonstrate the linear and hierarchical structure of the programme. In the knowledge/information gathering loop students develop skills to select the information that will serve for the purposes of the activities in the lesson, to categorise them and to associate them with the subject. In addition, they get an idea about the details, terminology, categories and methodology. In the analysis/critical thinking loop, they focus on the importance of and reasons for relationships. With the help of this focus, they learn how to study the separate elements of an issue or topic through organisational principles. Students also learn how these principles are regenerated in an entirely new and unique way. The application/creative thinking loop underlines that there is a need to use original ideas and evaluate the sufficiency of the products in order to come up with innovative products. Evaluation/decision making loop, on the other hand, emphasizes the evidence and criteria to select alternatives and to develop standards of judgement.

Critical and creative thinking are considered as skills in the programme. On one hand, the programme is skill-based, on the other hand it is mentioned that high-level thinking skills are linked with the principles of brain/mind based thinking. There is no grading for the programme and it can be used for all primary school students and adults.

The programme aims to develop decision making mechanisms taking critical thinking and creative thinking as a starting point. It is possible to say that innovative thinking is considered in the scope of creative thinking. As in each thinking programme, this one also redefines critical and creative thinking in its own frame.

8. Odyssey of the Mind

It is a programme initiated by Sam Micklus and Ted Gourley in 1978 at Glassboro State College (now Rowan University). In their initial work it was referred to as “Olympics of the Mind”. It aims to develop the creative thinking skills of the participants by means of problem solving and brainstorming (Wikipedia, 2013).

Odyssey of Mind is an educational programme which could also be defined as a creative problem solving competition for students of all grades. In general it has two categories: The first one is long-term problem solving, and the other one is spontaneous problem solving. In long-term problem solving, each team is given a specific problem and the individuals are then asked to solve this problem within a given time-frame. In spontaneous problem solving, the teams are supposed to find a solution during the competition in an impromptu way. In this way, students develop two different skills in two different categories. In developing

these skills, team work is utilised. There are four levels of age groups for team work: K-5 (U.S.) - K 6-8 (U.S.) - K 9-12 (U.S.) and higher education (Micklus & Micklus, 2013).

In long-term problem solving, each team works on 5 long-term problems. Teams compete by working on the same level. They prepare for the solutions of long-term problems prior to the competition. Each long term problem has one or more objectives, limitations, needs, as well as a series of conditions and grading categories. The stages of a long-term problem can be listed as follows (Micklus & Micklus, 2013):

Problem 1: Vehicle: Teams are expected to design one or more vehicle. These vehicles should be designed with sufficient space sometimes to get on, and sometimes to carry stuff.

Problem 2: Technique: Teams are scored for various technical work. They are usually expected to develop a device which is capable of accomplishing some specific tasks related to the given problem.

Problem 3: Classics: This one is about a problem-based performance about classics. It can be about any classic including mythology, art, music, archeology or something natural and classical.

Problem 4: Structure: Teams are expected to design and construct a structure by using only wood from balsa tree and glue. Then they test whether this structure can be broken by olympic units of weight.

Problem 5: Performance: It is about problems in which performance-based scoring is active and which deals with some special characters, sometimes with humour and sometimes an original story.

In solving spontaneous problems, on the other hand, the teams have no idea about the problems until they enter the competition room; hence, the problems can be considered "highly confidential". Solving such problems greatly contribute to students self-sufficiency. Each spontaneous problem has its own rules. Teams solve a spontaneous problem in each competition. These kind of problems are addressed on three different levels (Micklus & Micklus, 2013): verbal, applied and verbal/applied. Verbal problems involve dramatisation and improvisation; for applied problems tangible solutions are employed; and for verbal/applied problems both are utilised.

Students work in groups of seven under the guidance of a grown-up education coach. Solution phase may take weeks or even months. Each team has eight minutes in total to present its solution. Teams are scored considering to what extent the requirements of the solutions are met and the use of different categories of creativity. The results are published on the internet. Ranking of the teams are determined based on their scores in problem solving, score in style and score in spontaneous solutions. Teams have to follow the rules, problem limitations and the announcements made throughout the year (Micklus & Micklus, 2013).

The program takes creative thinking as a skill, so it would not be wrong to say that it is a program centered on thinking skills. In fact, this training program is reminiscent of an olympic race rather than a programme. It realizes creative thinking skills through problem-solving and brainstorming. In the program, creative thinking emerges as a result and is far more similar to problem solving based learning model. Creativity occurs during the spontaneous problem solving process and it is not a development which affects the whole programme.

Stages have been defined for the problems to be solved in the scope of the program, yet these are more related to the stages and types of problems rather than instruments of thinking. The program, in this state, does not systematically put forward a certain way of thinking, style or thinking instruments. The programme, with its various levels, is limited to primary and secondary education, and higher education.

COMPARISON OF THINKING EDUCATION MODELS AND QUADRUPLE THINKING MODEL

Comparison of thinking education models according to a number of criteria will shed light on the work done in the field of thinking education so far. Upon comparison of these structures, the distinctive quality of Quadruple Thinking Model, which is an original work, in relation to these comparison criteria will become more apparent.

Comparison of Thinking Education Models

When considered together with thinking models, it is clear that ways of thinking, thinking styles, thinking skills and instruments of thinking can be understood in different ways by different programs. The following table demonstrate the center point of programmes in terms of a set of criteria. When it is analysed, it can be understood that except the P4C program, the others lack a general holistic framework and a perspective. This holistic general framework and perspective should essentially be the determining factor of thinking styles, skills, and instruments. Without describing this structure, the function of others will not be fully understood. Instrumental Enrichment (I.E.) and The Thinking/Learning (T/L) System programmes address thinking styles; however, this involvement is only partial.

Most of the programmes consider thinking as a skill-centered concept. Tactics for Thinking, Structure of the Intellect (SOI), The Thinking/Learning (T/L) System and Odyssey of the Mind place thinking skills entirely in the centre, just as Cort-Lateral Thinking and P4C do the same thing, but partially.

Cort - Lateral Thinking and Instrumental Enrichment (I.E.) give the central role to instruments of thinking in their programmes. Similarly, H.O.T.S. and Odyssey of the Mind do the same thing, but partially.

Table 4: Comparison of Thinking Education Programmes

Thinking Education Programme/Model	General Structure	Individual Preferences	Teaching Content	Teaching Strategies
	Way of Thinking	Thinking Styles	Thinking Skills	Instruments of Thinking
CoRT- Lateral Thinking	○	○	●	●
H.O.T.S.(Higher-Order Thinking Skills)	○	○	○	●
Instrumental Enrichment (I.E.)	○	●	○	●
Philosophy For Children	●	○	●	○
Tactics For Thinking	○	○	●	○
Structure of The Intellect (Sol)	○	○	●	○
The Thinking/Learning (T/L) System	○	●	●	○
Odyssey of The Mind	○	○	●	●

● Present ● Partly Present ○ Absent / Not Available

Apart from the points stated above, Cort - Lateral Thinking considers creative thinking, H.O.T.S. considers critical and creative thinking, P4C consider creative and caring thinking, and Structure Of The Intellect (SOI) consider convergant and divergant thinking as a way of thinking.

The Thinking/Learning (T/L) System considers critical and creative thinking, and Odyssey of the Mind consider creative thinking as a thinking skill.

Except for P4C, all the other programmes are cognitive. P4C comprises both cognitive and affective structures. The factor leading to this difference is "caring thinking".

Quadruple Thinking Model

In the scope of the curriculum review process which was launched in 2005 by the Ministry of National Education in Turkey, an elective course on "Thinking Education" (MEB, 2007) was included in the curricula for 6-8 grades in 2006. When this course which was developed by a commission of researchers, is considered in

today's circumstances, it is possible to say that it functions effectively. A signature campaign was also initiated by many civil society organizations working in the field of education in order for this course to be compulsory and a "Teacher's Guide Book" (Dombaycı et al. 2008) has been prepared. Both the curriculum and its relevant manuals are based on Lipman's (2003) tripartite model of thinking (critical-creative-caring). The basic difference between this course and the model is that both prior to an activity or an attainment and at the end of it the expected piece of knowledge, skills, values and attitudes are clearly mentioned.

Considering the criticism, it becomes clear that a model for thinking education should be sensitive to pedagogy, and at the same time it has to attach importance to historical, social and cultural factors. Developed for this purpose, Quadruple Thinking (QT) Model presents an understanding of "human" for the education system. For QT Model, man is the subject of the act of thinking. Man is distinguished from other creatures with his "act of thinking". This distinctive feature also determines his conditions of existence: Human is a being who knows, does, hears the voice of others, adopts attitudes, foresees, pre-determines, wants, has free actions, idealises, commits himself to something, loves, works, educates, is educated, founds states, creates arts and technique, believes, talks, and has a bio-psychic structure (Mengüşoğlu, 1988).

QT Model, which also takes into account the conditions of existence, comprises four ways of thinking. These are critical, creative, caring, and hopeful thinking. Critical thinking is a way of thinking in which evaluation is based on criteria and decisions are made. Creative thinking, on the other hand is the "aesthetic problem-solving" ability. Caring thinking is a third and high-level of thinking which brings critical and creative thinking together. Caring thinking also consists of forms that make it possible for emotions to transform into selections, decisions and judgments. These forms contain the importance and value of the person himself, of others, of his surroundings and principles. Hopeful thinking is a person's emotional belief that the consequences of the events and situations in his life will be positive.

Critical and creative thinking is usually associated with the content and is about what is being thought. Caring and hopeful thinking, on the other hand, is rather more related to the perspective of the first two types of thinking about the object of their thought and is more about how we think about this object of thought. Caring thinking is the philosophical verification of critical thinking, and philosophical justification of creative thinking. Hopeful thinking increases the capacity of acting. Hopeful thinking enables individuals to be critical without being destructive, to be creative enough to keep a balance between imagination and real world, to be caring enough to think about him and others equally, and to be happy enough to perform all of these.

Guilford defines convergent thinking as the ability to narrow down the number of possible solutions by applying logic and knowledge to a problem, and divergent thinking as the ability to foresee multiple and original solutions to a problem. Accordingly, critical and caring thinking are kinds of convergent thinking, while creative and hopeful thinking are types of divergent thinking.

Critical and creative thinking is more associated with cognitive thinking. Because knowing, thinking, making associations, analyzing, and inferring are all about cognition and they are realised through cognitive processes. Caring and hopeful thinking, on the other hand, are more about emotional thinking. Senses, preferences, attentions, identifications, acceptances or rejections, values, and beliefs are the basic structures of affective processes.

"Human" should be the human seeking truth, pursuing the good, and believes in him and his actions. This is the basic concept of QT Model that regulates each way of thinking. They all feed on something different: critical thinking, on truth; creative thinking, on beauty; caring thinking, on good and hopeful thinking: on faith. Any way of thinking which does not value one or more of these and any education system that does not aim for one or more of these make the act of thinking insufficient.

Man's development in terms of his mind, emotions, individuality, and sociality makes it possible for him to think accurately and to be a healthy individual. When considered from this perspective, critical thinking is both cognitive and convergent, whereas creative thinking is also cognitive, but divergent. Caring thinking is both

affective and convergent, while hopeful thinking ensures affective and divergent thinking of the individual's (Bacanli, 2012). In QT Model these four ways of thinking are taken into account in combination with four different human features.

RESULT

Discussions on whether education programs for thinking should be developed regardless of the content or by associating it with the content have created a dilemma. This is a dilemma that must be addressed. One of the ways to solve this dilemma is to design the model of thinking education as an education system model or human model. Thinking skills should not be regarded as an independent field, but rather consider the whole education system and the human model that it aims to train as a context. In this sense, thinking skills should be considered as the skills of a particular way of thinking. It is not possible to establish a general perspective which is focused on these ways of thinking and to develop a holistic model of thinking education.

The QT Model, which was developed based on these grounds, is a model of thinking education which is not about a curriculum, a subject or a course, but about the education system and the human model it aims to raise. This human model does not separate human as a being and considers it as a whole without mechanising. In this sense, it serves as a model which takes into account both ontological and metaphysical aspects of human, emphasizes both his affective and cognitive side and considers both convergent and divergent aspects. Its most distinctive quality is this holistic approach and overall structure. Such a holistic approach and overall structure is not present in any of the programs analysed.

QT Model stipulates that thinking ways, skills, styles and strategies at all levels should be made clearly evident by adopting a programmed teaching. It also stipulates that each attainment should have a certainty about what is expected to be realised before and after the lesson. For this reason, QT Model is proposed for the education system itself. The thinking models examined are structures used outside of the education system in general.

QT Model also takes into account the epistemological, ontological, ethical and aesthetic dimensions of philosophy. Therefore, in the definition of human there is an emphasis on good, beautiful, true and believer. Based on the ways of thinking, a reflection of this emphasis is also visible in all thinking styles, strategies and instruments. When the analysed programmes are considered, such an approach cannot be detected. Inspired by the thinking system of Lipman, QT Model redefines critical thinking, creative thinking and caring thinking in the context of "human" perception. Due to the insufficiency of these three, he also added "hopeful thinking" which is an original way of thinking, into his model. Based on the above and other aspects of thinking, QT is different from other education models as a unique model and it is still being improved.

QTM is a model of thinking which does not consider any difference between grades. What determines the difference in levels would be the selection of the content of Thinking Model in accordance with the level of development.

With all the aspects listed above, QTM is an original model, different from the other models of thinking education, and it continues to be further improved.

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