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RESEARCH ARTICLE

TRANSFORMATIONAL APPLICATION AVENUE OF CORT THINKING STRATEGY FOR HIGHER EDUCATION.

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Abstract

This paper endeavored to present a systematic review on the effectiveness of the CoRT thinking strategy in stimulating the thought mechanism of creativity in higher education. The reviews were drawn from quasi-experimental and true experimental studies as a platform to encourage the use of thinking strategies at the higher education level, not just for their academic achievement but for developing the 21st century learning skills - Critical Thinking, Communication, Collaboration and, Creativity and Innovation (The Partnership Framework for 21st Century Learning, 2011). These findings promote the effectiveness of the CoRT thinking strategy in stimulating creative and critical thinking skills, vital for survival in the fast paced world. Implications can be drawn for policy makers, practitioners and researchers as reminder that only a fraction of our mind is at use, indicating the need to lean forward and stretch one's efforts towards reforms in education as a whole.

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Introduction:-

Life in the 21st century is a direct consequent of globalization and the onslaught of the technological revolution which necessitates millennia's to be thinkers who can cope with the avalanche of information. There is growing consensus among educators, educational ministries and governments, organizations, employers and researchers to accommodate characteristics of 21st century learning skills (critical thinking, communication, collaboration, and creativity and innovation) in the present education system through interdisciplinary themes and strategies that stimulate 21st century thinking skills. Many countries of the Organization for Economic Cooperation and Development (OECD, 1990) have raised the need for effective efforts in teaching and learning of 21st century skills especially, of thinking skills like – Critical Thinking, Communication, Collaboration and, Creativity and Innovation (The Partnership Framework for 21st Century Learning, 2011). However, many still question the need to teach thinking skills deliberately in the classrooms as it is assumed that thinking is a natural activity that every human engages in everyday life and, still preferring the traditional drill and kill approach which has long been deemed inadequate in educating 21st century learners. They need to develop healthy habits of mind that support creative and critical thinking that expand their reach to the exceptional. Coached to be inventive thinkers, observant to evaluate opportunities and ideas that positively affect organizations and communities in which they work and live in (Metiri Group and NCREL, 2003). Teaching thinking skills should be an imperative part of our education system to produce

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citizens that can play a constructive role in society. Thus, a major overhaul of the resources, attitudes and understanding of our education system is required so that teaching of thinking skills can be expanded.

Conceptual Bases of Thinking Skills:

The ability to think enables human beings to make sense of experiences, solve problems, make decisions, ask questions, make plans, and organize information. It is this ability that enables us to manage our thinking effectively to comprehend, reason and test hypothesis as scientific thinkers. In other words, as good thinkers one should be able to exert control over their thinking. But, not everyone is able to exercise this essential skill as good thinking requires a desirable atmosphere that compels and gives freedom for individuals to think creatively and critically. The conceptual bases of the Creative and Critical thinking skills are highlighted below.

Creative Thinking:-

The creative thought mechanism is the ability to see or do things in a novel way, characterized by – Fluency (generating many ideas), Flexibility (shifting perspective easily), Originality (conceiving of something new), and Elaboration (building on other ideas). Creative thinking enables one to identify distinct behaviors that lead to new set of solutions to a problem. At the higher level, creative thinking involves deliberate and active engagement to bring together existing ideas into new configurations, develop new properties or possibilities for something that already exists, and discovering something entirely new. It is about generating ideas within or across domains of knowledge, breaking established symbolic rules and procedures to produce novel ideas.

Critical Thinking:-

Critical thinking is the ability to think clearly and rationally about what to do or what to believe. It includes that ability to engage in reflective and independent thinking. Critical thinkers are able to identify assumptions, recognize important relationships, make correct inferences, interpret and evaluate evidences, and solve problems. They are much more engaged with what they do. They question, look in depth, they don't just try to find the answer for a test. They try to rule out important relationships, deduces conclusions from the information, evaluate evidences (Paul, 1993).

With the shift in the way we live and work, the skill to think creatively and critically has become crucial in adapting and adjusting to changes. The larger economy is forcing the educational systems worldwide to rethink its current systems and practices.

Justification:

PISA (Programme for International Student Assessment, 2003) expressed that education systems worldwide were not outstandingly successful in preparing students with the kinds of thinking skills to form the foundation for 21st century skills. Many lack the ability to recognize assumptions, to evaluate arguments, and to appraise inferences (Norris, 1985) which are essential qualities to becoming a critical and a creative thinker. Another, major factor is that it is possible to enhance learners thinking skills through the application of proper instruction and practice. Following are some of the thinking strategies developed by various researchers – CoRT (Cognitive Research Trust), HOTS (Higher Order Thinking Skills), ICE (Institute of Creative Education), KIDS (Kids Interest Discovery Study Kits), SAGE, TU (Talents Unlimited) and THINK etc. (Cotton, 1991) to stimulate creative and critical thinking skills. These strategies make students perform cognitive challenges (Vygotsky, 1987) that help to effectively stimulate thinking. Out of all these strategies, the researchers have focused on the Cognitive Research Trust (CoRT) which developed by Dr. Edward de Bono in the 1973. CoRT stands for 'Cognitive Research Trust' which Dr. Edward de Bono had established in Cambridge, England. This trust consist of thinking lessons developed on the premise that thinking is a skill that can be enhanced and learned by deliberately engaging in 6 directions of thinking, namely - Breadth (CoRT 1), Organization (CoRT 2), Interaction (CoRT 3), Creativity (CoRT 4), Information (CoRT 5) and Actions (CoRT 6). These lessons can be applied to an extensively variety of problems such as business, education and life.

Objectives of the Study:

There are large body of research in relation to the teaching of creative and critical thinking skills at various stages of education using the CoRT thinking strategy, yet, it appears that there are considerable gap in the knowledge about the conditions under which instructions could result in creating transformational avenues. Through this study, an attempt was made to present studies that have effectively used the CoRT thinking strategy in stimulating creative

and critical thinking skills at various levels of education, especially at the higher education level to make appropriate suggestions for application in higher education.

Transformation of Higher Education:

The CoRT thinking strategy have successfully been used by many countries to enhance the creative and critical thinking skills among various groups of learners (Al-Faoury, 2007; Melhem, 2013; Alghafi, 2014; Hmeadat, 2016) as these its lessons were deliberately designed to be used by students of any age/grade level (Baum 1990). A positive effect was reported by Dobozy (2012) when CoRT was used as a Knowledge Mobilizing Strategy. Significant differences in the scores of Creative Thinking (Fluency and Flexibility) was reported by Alghafi (2014); Hmeadat, (2016). At the school level, the CoRT thinking strategy had significant effect in developing the critical thinking ability of the learners (Al-Edwan, 2011; Alghafi, 2014). While at the University level, CoRT thinking strategy showed positive effect in enhancing learner's achievement and in extending the learning outcomes (Ramadan, 2015). Rule (2012) studied the use of thinking skills system to guide discussions during working conference organized for students with disabilities pursuing STEM (Science, Technology, Engineering & Mathematics) wherein CoRT was used in 5 small group dialogue sessions. The Breadth (CoRT 1) thinking tools provided a robust structure for guiding meaningful discussions and in generating questions for future working conferences. The study by Johnstone (2008) on IT students of an Australian university reported that students improved in their problem solving ability by undertaking structured thinking exercises, thus, validating the effectiveness of the thinking strategy in developing thinking skills among university students. The study by Ganado (1997) indicated that the CoRT 1 helped in enhancing group activities and in the acquisition of thinking skill for maintaining interpersonal skills which form an integral part of the thinking lessons. The above mentioned studies highlight the effectiveness of the CoRT thinking strategy in stimulating thinking skills at various stages of learning and its inclusion in the Indian education system can significantly contribute in the efforts to produce capable 21st century learners. Positive efforts need to be made to teach creative and critical thinking skills with CoRT. Thus, transforming 21st century education is about making sure that the learners possess the necessary skills set that can create rippling effect to all sections of the society as they adopt and adapt their skills in favor of universal excellence.

Table1:-Recent Reviews of studies that used CoRT Thinking Strategy

No.	Study	Author	Educational Level	Measurement Tools	Findings
1.	Adaptation of the CoRT Thinking Program and to Study its Effect on the Children's Creativity	Kachhia (1990)	7 th Standard	Creativity Ability Test and CoRT	Significant
2.	The Direct Teaching of Thinking Skills for Improvement of Reading Comprehension Skills	Aegler (1993)	Elementary School Students	Stanford Diagnostic Reading Test and CoRT	Significant
3.	Integrating the Cognitive Research Trust (CoRT) Programme for Creative Thinking into a Project-Based Technology Curriculum	Barak (2006)	-	CoRT	Significant
4.	The Effect of Teaching CoRT Program No. (4) Entitled 'Creativity' on the Gifted Learners' Writing in Ein El-Basha Center for Gifted Students	Al-Faoury (2007)	Higher Secondary School Students	Creativity Test developed by the researcher and CoRT	Significant
5.	Creativity Training Effects Upon Concept Map Complexity of Children with ADHD: An Experimental Study	Alkahtani (2009)	4 th and 5 th Standard	Torrance Test of Creative Thinking and CoRT	Significant

6.	A Critical Thinking Module Evaluation	Donaldson (2010)	University Students	CoRT	Significant
7.	The Effectiveness of a Training Program Based on Cognitive Research Trust Strategies to Develop Seventh Grade Students' Critical Thinking in History Course	Al-Edwan (2011)	7 th Standard	Critical Thinking Test developed by the researcher and CoRT	Significant
8.	Creativity and Thinking Skills Integrated into a Science Enrichment Unit on Flooding	Rule (2012)	University Students	CoRT (Breadth)	Significant
9.	Using a Thinking Skills System to Guide Discussions During a Working Conference on Students with Disabilities Pursuing STEM Fields	Rule and Stefanich (2012)	Pre-University Engineering Students	STEM and CoRT	Significant
10.	The Effect of Integrating Creative and Critical Thinking on School Students' Thinking	Alghafi (2014)	5 th Standard	CoRT	Significant
11.	Effectiveness of Creativity Training Program on Concept Map Performance of Secondary School Students	Kumari (2014)	Secondary School Students	CoRT	Significant
12.	The Effect of the Modified CoRT Program in Enhancing Critical Thinking and Improving Motivation to Learn among Students with Learning Difficulties in Mathematics	Melhem (2013)	6 th Standard	CoRT	Significant
13.	Developing Instruments to Measure Thinking Skills and Problem Solving Skills Among Malaysian Primary School Pupils	Ngang (2014)	4 th , 5 th and 6 th Standard	CoRT	Significant
14.	The Effectiveness of CoRT Training Program on the Creativity of the Jordanian English Language Learners	Hmeadat (2015)	7 th Standard	Torrance Test of Creative Thinking and CoRT	Significant
15.	The Impact of a Thinking Skill Program, CoRT Breadth of Thinking on Students' Test Scores and Thinking Behavior in Lebanon	Ramadan (2015)	School Students	CoRT	Significant
16.	The Effect of the 1 st Part of the CoRT Program for Teaching Thinking (Breadth) on the Development of	Alshurman (2016)	University Students	Scale for Communication Skills was developed by the	Significant

	Communication Skills Among a Sample of Students from Al al-Bayt University in Jordan			researcher and CoRT	
17.	The Different Impact of SCAMPER and CoRT Programs on Creative Thinking among Gifted and Talented Students	Khawaldeh (2016)	School Students	Torrance Test of Creative Thinking and CoRT	Significant
18.	Reaction of English Language Learners on the Effectiveness of Thinking Training Programme CoRT for the Development of Thinking Skills	Pahuja (2017)	Bachelor of Education (B. Ed.) Students	CoRT	Significant

Table 1 presents 18 studies closely evaluated to determine the effectiveness of the CoRT thinking strategy at various level of education. Majority of these studies used the quantitative approach in an experimental setting, while the study by Donaldson (2010) evaluated the effectiveness of CoRT using the qualitative approach to give a broader perspective on the thinking tools of CoRT. Out of these 18 studies, 11 were conducted at the school students, 1 on higher secondary school students, 2 on pre-university students, 4 studies on university students. For data analysis, the statistical techniques ANOVA, ANCOVA, MANCOVA, t-test and Paired Samples t-test were used and the findings showed significant effect of the CoRT thinking strategy on the different sample groups.

Discussion and Suggestions:-

1. Thinking skills are teachable – In a rapidly changing technologically oriented world it is necessary to have well-developed thinking skills. Although, it was once believed to be an inborn quality to be a creative and critical thinker, but the above mentioned studies shown that these skills are teachable and learn-able through deliberate practice.
2. Infusing the teaching of thinking skills into content instruction – This involves teachers designing lessons based on the CoRT thinking tools and the curriculum simultaneously. By putting emphasis on higher-order thinking into content instruction, deeper understanding can be achieved for better writing and engaging the interest of students in what they are learning. When infusion is accompanied with the introduction of explicit thinking strategies, together with highly scaffold guidance by the teacher, and promoted reflective meta-cognition and strategies planning by students, a very powerful learning environment for teaching thinking can be created.
3. Training teachers to teach thinking skills can lead to gain in student achievement – The CoRT thinking strategy can be more effective when used by teachers who are well versed and acquainted with the thinking tools. Majority of the thinking programs have a strong teacher training component, and consider training to be as important as the content of the strategy in bringing about the learning gains. In addition, Sternberg (1986) and Baum (1990) cited a positive relationship between teacher training and student achievement.
4. Fostering a climate conducive for the stimulation of thinking skills –Behaviors which all good teacher should be familiar with like – setting ground rules well in advance, providing well-planned activities, showing respect for each student, providing non-threatening activities, being flexible, accepting individual differences, exhibiting a positive attitude, modeling thinking skills, acknowledge every response, allow students to be active participants, create experiences to ensure success at least part of the time for each student and using a wide variety of teaching modalities.
5. Thinking skills instruction requires time, administrative support and institutional commitment in order to be effective.
6. Focused attention – The thinking tools of CoRT deliberately direct the attention of the learners towards using one thinking skill at a time. This helps the students to have focus to gain concrete results in the form of new and original ideas. The learners take active participation in the thinking process resulting in an atmosphere where ideas can be actively shared.
7. Efforts to teaching thinking skills should be aimed at helping students not only learn how to manifest these thinking skills, but also to developing the habit of using these thinking skills through continued practice and sensitivity to where these skills are needed (Swartz, 2014).

Conclusion:-

The thinking tools of CoRT when practices effectively does develop focus to introspect their own thinking (meta-cognition), enhance self-awareness and break through past, unproductive patterns of thought that stifle creativity and hinder critical thinking. The thinking tools also encourage the user to step back, refocus and recognize new perspectives. Such improvements become evident in the students' open minded attitude, independent thinking, learning and critical thinking skills. But to promoting these avenues to our 21st century learners, we need to dig deeper to the change the underlying paradigms of thought and apprehensions about teaching thinking. The change has to start by equipping higher education teachers with right knowledge and skills by increasing the awareness about the importance of teaching how to think using the CoRT thinking tools. Thus, transformation can take place by harnessing the strengths, knowledge and skills of those around to have a greater insight into the impending issues.

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