Role of Technology in Promoting Higher Order Thinking Skills

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Abstract
Cognitive ability like thinking may be considered to be one of the chief characteristics which distinguish human beings from other species including the higher animals. The challenges and problems faced by the individual or by society, in general, are solved through serious efforts involving thinking. Thinking refers to a pattern of behaviour in which we make use of internal representations of things and events for the solutions of problems. Moreover, thinking is largely affected through inducement by sets habit or the way we habitually perceive, certain situations. These induced sets are quite often the results of our interest’s directions and purposes. Globalization and advancements in technology are driving changes in the social, technological, economical, environmental, and political landscapes at a rate and magnitude that is too great, and too multiple to ignore in Higher Education. As society changes, the skills that students need to be successful in life also change. Basic literacy skills of reading, writing and mathematics are no longer sufficient; students need to master those basic skills as well as read critically, write persuasively, think and reason logically, and solve complex problems. A successful student in higher education must also be adept at managing information finding, evaluating and applying new content understanding with great flexibility. They must be equipped with skills and perspective designed to help them anticipate change and plan accordingly. This will equip them to thrive in a world characterized by rapid continuous change.

Keywords: Cognitive Ability, Literacy Skills, Thinking Skills, Knowledge Acquisition, Technology Role
1 Introduction

Thinking is one of the important aspects of one’s cognitive behaviours. It provides the base on which not only our cognitive but also affective and conative behaviour depend. It not only helps in solving the numerous problems one faces in one’s practical life, but also helps in striving to solve the most typical social, cultural and scientific problems for the uplift of the society and humanity. Therefore, thinking refers to a pattern of behaviour in which we make use of internal representations (symbols, signs, etc.) of the things and events for the solution of some specific purposeful problem. “Images”, “concepts”, “symbols”, “signs” and “language”, are explicitly the “tools of thinking”. As thinking is an inner cognitive process, it has a definite end or purpose, it is initiated to solve some difficulty or problem and ends in its solution. In the solution of the problems, it does not resort to motor exploration, but there is a mental manipulation of the objects, activities and experiences. As emphasized earlier, thinking is an essential inner cognitive process that helps us in so many ways for solving the faced problem and coping up with the environmental needs. Thinking, falling in the cognitive domain of our behaviours, is a skilled act. One is not a born thinker; he has to learn the art of thinking by acquiring a set of thinking skills. The significance of acquiring thinking skill is in one’s behaviour and functioning is now altogether recognized everywhere. Knowledge getting, and not the knowledge is now recognized as more important and the knowledge getting process can only be mastered through one’s developed thinking skills. Thinking skills are a part and parcel of our cognitive behaviour, cognition refers to the mental operation involved in thinking, the biological/ neurological processes of the brain that facilitate thought. The term, thinking skills, infer a set of mental abilities or skills that help us in carrying out our thought process at the desired level of our cognitive functioning for achieving the personal, professional or social ends.

2 The Higher Order Thinking Skills

Effort world-wide are increasing to infuse thinking skills into the curriculum, to include them in the instructional strategies, and to assess success in teaching thinking. Needless to say, creative and critical thinking as well as Problem solving skills are needed for academic and social excellence. Higher order thinking by students involves the transformation of information and ideas. This transformation occurs when students combine facts and ideas and synthesise, generalize, explain, hypothesise or arrive at some conclusion or interpretation. Manipulating information and ideas through these processes allows students to solve problems, gain understanding and discover new meaning. In helping students, become produces of knowledge, the educator’s main instructional task is to create activities or environments that provide them with opportunities to engage in higher order thinking.

Education should ideally move students beyond mere-memorization of information and simple understanding of concepts covered. The goal of education is to help students use what they learn, to create something new or to arrange information in a new way. Thinking beyond the level of knowledge acquisition is considered complex thinking – that which requires effort and produces outcomes that may
differ from one statement to another. These outcomes are not predictable because the process of higher-order thinking is not mechanical. Central to higher-order thinking is the ability to work through new challenges with understanding and empathy and rise to meet those challenges.

3 The Role of Educational Institutions in the 21st Century

The world is undergoing a revolution and so, the role of educational institutions is fast changing. There is a need for new organizational structures for higher education to provide the administrative and educational support for life-long learners. The critical roles of an educational institution are to build and meet the learning needs of the 21st century, which allows students to prepare for careers, requires them to acquire new knowledge, learn new technologies, rapidly process information, make decision and communicate in a global and diverse society.

There is a need for students in Higher Education to develop learning skills that enable them to think critically, analyze information, communicate, collaborate and problem-solve and realize the essential role that education plays in realizing these learning skills in today’s knowledge-based society. These are skills and practices that can be rooted in day-to-day teaching-learning process. Change in teaching approach from teacher-centric to student centric would definitely imbibe these essential skills among students. Incorporating various methodologies like activity-based learning and effective technology integration in every day class-room practices will lend for promoting 21st century skills among students.

4 Creative Thinking, Critical Thinking and Problem Solving-The Higher Order Thinking Skills

4.1 Creative Thinking

It is a type of thinking which helps an individual to create, discover or produce a new idea or object including the re-arrangement or reshaping of what is already known. As a component or factors, psychologists have concluded the presence of following factors in one’s creative thinking: (i) Ideational Fluency (ii) Originality (iii) Flexibility (iv) Divergent thinking (v) Self-confidence and persistence (vi) Ability to see and build relationship.

4.2 Critical Thinking

It is a type of thinking that helps a person in stepping aside from his own personal beliefs, prejudices and opinions to root out the facts and discover the truth, even at the expense of his basic belief system. It represents a challenging thought process, taking to new avenues of knowledge, understanding and to a set of higher cognitive abilities and skills for the proper interpretation, analysis, evaluation and inference, as well as explanation of the gathered or communicated information resulting into a purposeful,
unbiased and self-regulatory. It proves to be a back-bone and a reliable support for carrying out the process of problem solving.

Table 1: The following table shows 21st Century skills

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| 1. Information & Communication Skills | a) Information and Media Literacy Skills  
Analyzing, accessing, managing, integrating, evaluating and creating information in a variety of forms and media. Understanding the role of media in society.  
b) Communication Skills  
Understanding, managing and creating effective oral, written and multimedia communication in a variety of forms and contexts. |
| 2. Thinking and Problem Solving skills | a) Critical Thinking and Systems Thinking  
Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems.  
b) Problem Identification, Formulation and Solution  
Ability to frame, analyze and solve problems.  
c) Creativity and Intellectual Curiosity.  
Developing, implementing and communicating new ideas to others, staying open and responsive to new diverse perspectives. |
| 3. Interpersonal & Self-Directional Skills | a) Interpersonal and Collaborative Skills  
Demonstrating team work and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, respecting diverse perspectives.  
b) Self-direction  
Monitoring one’s own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another.  
c) Accountability and Adaptability  
Exercising personal responsibility and flexibility in personal work place and community contexts; setting and meeting high standards and goals for one self and others, tolerating ambiguity.  
d) Social Responsibility  
Acting responsibly with the interests of the larger community in mind, demonstrating ethical behaviour in personal, work place and community contexts. |
4.3 Problem Solving

It is a deliberate and serious act, involving the use of some novel methods, higher thinking and systematic planned steps for the realization of set goals. They systematic steps involved in effective problem solving may be identified as problem awareness, problem understanding, collection of relevant information, formulation of hypotheses and selection of a proper solution. Problem solving behaviour depends on factors inherent in the nature of the problem and factors associated with the problem solver like his level of previous learning, interest and motivation way of solving the problem, mind-set, function way of solving the problem, mind-set, functional fixedness, mental and physical status, and the time spent by him in the problem solving.

5 The Gateways: An Insight

To promote higher-order thinking skills, Higher Education can take into consideration the role of Direct and Indirect way of teaching thinking, ICT and Metacognition.

5.1 Role of Direct and Indirect Ways of Teaching Thinking

5.1.a Direct Ways

- Equipping with knowledge and skills regarding tools of thinking (Images, Concepts, Symbols, Signs and language).
- To develop linguistic ability.
- Thinking from concrete to abstract.

5.1.b Indirect Ways

- Training to develop functional relationships.
- To discover knowledge through activities (curricular and co-curricular) like puzzles, etc.
- Responding to verbal and non-verbal standardized tests in different situations.
- Engaging in verbal dialogue and conservations, writing or experimenting.
- Adopting, Algorithms (strategy for generating a solution by exhausting every possible answer for ending up with correct solution), Heuristics (rule of thumb for arriving at a quick solution) and Analogy (using one’s experience, training and practice work).

5.2 Role of Information and Communication Technology (ICT)

There are three main ways of thinking about the role of ICT in teaching thinking skills.

(i) **As Tutor or Teaching Machine** – With the right teacher input and software design, group-work around computers can turn the use of reasoning skills into learning outcomes.

(ii) **As Mind Tools** – Mind tools are computer applications that when used by students to represent what they know necessarily engage them in studying. Mind tools scaffold different
form of reasoning about content. That is, they require students to think about what they know in different, meaningful ways.

(iii) As a Support for learning Conversation – Networks can allow students to engage directly in knowledge creation thinking, together with others at a distance can be more motivating and can stimulate higher quality of thought, than thinking together with others in the same classroom. The computers can be used as a support and resource for the communicative processes of teaching and learning.

5.3 Role of Metacognition

“Meta cognition” is often simply defined as “thinking about thinking”. “A metacognitive strategy is a systematic cognitive technique to assist students in recognising, planning, implementing and monitoring solutions to problem”. (Smith Steven W, 1992).

The basic metacognitive strategies are:-
- Connecting new information to former knowledge.
- Selecting thinking strategies deliberately.
- Planning, monitoring and evaluating thinking processes (Drikes, 1985).

5.3 a Facilitation of Metacognitive Strategies

- Identifying “What you know” and “what you don’t know”
- Talking about thinking.
- Exposure to problem-solving strategies.
- Using Prompts.
- Keeping a thinking journal.
- Planning and self-regulation.
- Debriefing the thinking process.
- Self-evaluation.

6 Conclusion

Various research studies that instruction that builds upon and encourages the use of Higher order thinking skills yields greater levels of student learning. Using Direct and Indirect ways, ICT and Metacognition, which play a key role in developing constructive publications would, effectively translate the ideas of the learner. Students spend time productively creating strategies for solving complex problems and developing a deep understanding of the subject matter. So the process of development of higher-order thinking skills is internal and personal. It becomes imperative for the students to present, publish and share their ideas or products resulted from critically analyzing and evaluating the information.

Much depends on the role of the educator students need to know what the thinking skills are that they are learning and these need to be explicitly modeled, drawn out and re-applied in different contexts.
Promoting higher order thinking skills is a winning strategy in Higher education and is well worth the investment of faculty time and energy to benefit student learning in our class-rooms and courses.

7 References

[16] Websites